SCHOOL LIFE

OFFICIAL JOURNAL OF THE ★ ★ ★ ★ ★ ★ ★ ★ ★

OFFICE OF EDUCATION

In This Issue

March 1960

OUR COLLEGES . . .

OUR COLLEGES and universities play key roles as creators of attitudes, molders of thought patterns, and searchers after truth. They are the leaven in cultural understanding. They are the catalyst in the exchange of ideas and concepts on an international scale. As America's horizons have broadened to encompass our most distant neighbors and circumstances have combined to open new channels of communication and understanding with the emerging nations of the world, our institutions of higher learning have been invaluable assets in improved world understanding. As we become better acquainted with our friends as well as with those who differ with our way of life, it is only natural to expect many significant changes in curriculum and methods of instruction on our campuses. Science and mathematics were the first subject-matter areas to feel the effect of international tensions. Foreign language also has experienced a rebirth. This kind of action is necessary all across the curriculum board.

If there is to be world understanding, it will follow in the wake of improved communication. Our college curriculums must be structured in such a manner that they will contribute to this end.

Lawrence G. Derthick

From "Missions for the Future," an address at Washington Missionary College, Takoma Park, Md., March 23, 1960.

CONTENTS

U.S. DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE • ARTHUR S. FLEMMING, *Secretary*

OFFICE OF EDUCATION . . . LAWRENCE G. DERTHICK, *Commissioner*

CARROLL B. HANSON, *Director, Publications Services*

SCHOOL LIFE
March 1960
Vol. 42 . . . No. 7

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School Life reports Office planning and action and publishes articles by members of Office staff; presents statistical information of national interest; reports legislation and Federal activities and programs affecting education. Published monthly, September through May.

Printing approved, Bureau of the Budget, July 28, 1958. Contents not copyrighted. Subscription: Domestic, $1 per year; foreign, $1.50; 1-, 2-, and 3-year subscriptions available. Single copies, 15 cents. Send check or money order (no stamps) to the Superintendent of Documents. U.S. Government Printing Office, Washington 25, D.C.

Brief . . . . . EDUCATION AND GOVERNMENT Reports . . . . . .

100 Years for the Signal Corps

WIGWAG flags by day and torches by night were the first communication devices used by the Signal Corps of the U.S. Army, which completes 100 years of service to the Nation this June. In its first century the Corps has advanced both military and civilian communications. Both the Air Force and the weather service had their beginning in the Corps. Man's first contact with the moon was accomplished by radar at the Signal Corps' Radar Laboratory, Camp Evans, N.J. It was the Corps that developed the solar cell conversion for powering the satellite radio in Vanguard I. Together, the Corps and industrial specialists have developed MISSILE MASTER (an air defense system) and an electronic control and coordination system for use with the NIKE and HAWK missile batteries.

Among the Corps' most distinguished members was A. W. Greely who, in 1881, led a 25-man expedition to Ellesmere Island near Greenland to explore unknown areas of the Arctic. Lt. Greely was one of the seven who returned alive. In 1887 he became Chief Signal Officer, and during his 19 years as head of the Corps he did much to advance its services by promoting the use of photographic equipment, underground cable, telephones, radios, and balloons.

In 1907 the Wright Brothers built the Corps' first airplane, in which Orville Wright nearly lost his life when the plane crashed two weeks after delivery. The Wrights delivered a second plane to the Corps in 1909; in May 1918 the air wing of the Corps became a separate army unit, eventually growing into the Air Force we know today.

Now under its 18th commander, Major General R. T. Nelson, the Corps continues to work toward improving communications for the Army and the advancement of electronic science for the civil needs of the Nation.

Toward youth fitness

FITNESS Can Keep U.S. Strong, the theme for National Youth Fitness Week, May 1–7, 1960, was uppermost in the minds of the 100 or more persons who attended a workshop on February 9 in Washington, D.C., to consider health and physical education programs that would promote the fitness of American youth. The hundred participants represented public and volunteer health agencies, health and physical education organizations, education, and the Federal Government. Speakers included Philip E. Ryan, executive director of the National Health Council and a member of the President's Citizens Advisory Committee on the Fitness of American Youth, and Albert L. Chapman, chief of the Division of Special Health Service of the U.S. Public Health Service.

Called to supplement the work of the President's Council on Youth Fitness, the workshop considered ways in which organizations can cooperate in celebrating National Youth Fitness Week and how they can contribute to programs for youth fitness.

The conference suggested that President Eisenhower be asked to appear on a nationwide television program during the week; that local committees be established for coordinated planning; that each organization stress fitness in its publications and periodicals; that schools highlight fitness activities; and that health agencies cooperate in as many ways as possible. To promote continuing programs, the conference suggested that each organization use services now available to the fullest; that they prepare visual materials on youth fitness programs; and that instruction in physical education and recreation be accelerated to keep pace with the increased emphasis being given to science, mathematics, and foreign language instruction.

Title X survey in higher education

INFORMATION on Federal Government programs for higher education and the effects of such programs on institutions has been scant, but under the provisions of Section 1001(d) of the National Defense Education Act of 1958, the Department of Health, Education, and Welfare, through the Office of Education, is acting to gather complete information on these programs and to make it

available where needed. Section 1001(d) directs the Secretary of Health, Education, and Welfare to advise and consult with the heads of Federal departments and agencies responsible for the administration of scholarship, fellowship, or other educational programs to obtain full information on such programs and to develop policies and procedures to strengthen the programs and objectives of the higher education institutions participating in Federal programs.

The Secretary has delegated to the Commissioner of Education the responsibility for conducting the survey of Federal programs in higher education. To discharge his responsibility, Commissioner Derthick is taking two steps. He has appointed J. Kenneth Little, associate director of the Committee on Institutional Cooperation of the Big Ten Universities and the University of Chicago, to the recently created position of Director, Survey of Federal Programs in Higher Education; and will soon establish a 12-man committee of leaders in higher education to advise him on the scope and direction of the program. Dr. Little is not new to the Office: he was Deputy Commissioner of Education from May 1954 to June 1955.

The purpose of the survey will be to make an inventory of Federal programs using colleges and universities, identify the policies and procedures of Federal agencies that significantly affect these programs, and recommend to agencies policies and procedures whose development or revision would strengthen the programs of colleges and universities taking part in Federal education programs. When completed, the survey should show the range of Federal activities in higher education, describe the ways in which Federal activities affect college and university programs, and identify the areas in which problems arise between institutions and Federal agencies; it should also suggest policies and procedures to strengthen college and university programs.

Foreign students in the U.S.A.

THAT opportunities are many for foreign students in U.S. colleges and universities is attested to by the fact that 47,245 students from other countries attended our institutions in 1958–59. In addition, our university-affiliated hospitals had 8,392 foreign resident physicians and interns during the last academic year. Students from the Far East and Latin America accounted for about 55 percent of the total. Nearly 300 students came from Communist countries—about a third of them from Yugoslavia. The U.S. Government gave total support to 2,273 students, partial support to 979. Nearly 20,000 were self-supporting; 13,000 received support from private organizations, 2,318 from their own governments. Source of support for 8,722 students was not known.

Compiled by the Office of Education from a census taken by the Institute of International Education, this information was given to the press this month by Arthur S. Flemming, Secretary of Health, Education, and Welfare. The Secretary had the Office gather this information to satisfy a request made to him at a news conference for information on foreign students.

International book exchange

NOT many North Americans have heard of Azul, Argentina, but to the staff of the U.S. Book Exchange in Washington, D.C., it is famous. In January of this year the Pan American Zoonses Center in Azul received the millionth item shipped by USBE to an International Cooperation Administration's overseas library (there are more than 1,000 ICA-sponsored libraries). Since March 1954 USBE has had a contract with ICA to supply libraries over the world with U.S. technical and scientific publications not otherwise available to them. The first public library in North Africa's Eritrea, for instance, has received over 7,000 items through USBE. USBE provides a continuing service to the ICA industrial technical cooperation program overseas, and its material supports other material supplied by ICA and particularly complements ICA's technical literature program.

A private, nonprofit, self-supporting organization, USBE is sponsored by member associations of the Council of National Library Associations, by such educational associations as the American Council on Education, and by these Federal agencies: Library of Congress, National Academy of Sciences-National Research Council, National Library of Medicine, Smithsonian Institution, and the Department of Agriculture.

Any institution in the world can be a member of the Exchange if it has a library, has publications to offer in exchange, and needs material for its own collection. Members in the United States and Canada pay handling fees on material they receive as well as shipping costs on material they contribute. Member libraries receive *unit credits* on material USBE accepts from them, which they then use in obtaining other material. USBE places no monetary value on any item it receives.

ICA missions receive requests for USBE membership directly from the libraries in the host countries, and send the approved applications to headquarters in Washington for processing by USBE. USBE forwards notification of acceptance, directions for ordering materials, and monthly lists of available publications. From these monthly lists the USBE member library asks for material it needs. The only expense to an overseas library is the cost of shipping material to USBE in Washington; it must contribute material in order to establish exchange credit. A new library may receive advance credit until it can build up its collection.

Correspondence with USBE should be addressed to Alice D. Ball, executive director, at the US Book Exchange, Inc., 3335 V Street, NE., Washington 18, D.C.

From the President of the United States to the White House Conference on Children and Youth

Excerpts from his address at the first session, University of Maryland, March 27, 1960

* * * It is not my purpose to advise you on what you should do at this conference, but it may be appropriate to suggest a few reasons why, to me, your mission here is so important.

First, then, you are working with the most precious resource of our Nation—indeed of the world: a whole generation who will someday make their country's policies and dispose its great power. The very life of America depends upon the wisdom and resourcefulness which they will bring to the basic problems with which they will then be confronted. And the responsibility for their early preparation belongs to the older citizen, not to the younger one.

Now, second, this process of preparation for tomorrow's leadership grows increasingly difficult as rapid and momentous changes alter the look of tomorrow's world.

Half a century ago, when the first of these conferences met at the request of President Theodore Roosevelt, the automobile was just beginning to be a fairly common sight on the landscape of America. Radio was a laboratory toy, and television was yet even a dream. Bleriot had still to make his famous flight across the English Channel. Wars, though destructive, were so confined to particular areas that the remainder of the earth was only indirectly affected by their outbreak. Events, and news of events, moved slowly, and there was a feeling of permanence and stability in the world that people born in this century have never known. * * *

Now, in contrast, the world fairly shakes with the heavy tread of humanity on the march. Tonight, as I speak to you, an American space vehicle 2,310,000 miles away in its orbit around the Sun is telling what it sees and feels on its cosmic journey. Who can predict what miracles may be witnessed by those who sit at the Youth Conference ten years from now?

A billion people have been added to the earth since the first Youth Conference, a half billion more will arrive before the next one convenes. In America we race to prepare for the surge of children—fifty million of them—who will enter our homes during the next decade. Jet aircraft have shrunk our world by half during the past five years, and we no longer see anything unusual in lunching in New York and dining, the same day, in Lima, Peru. As this shrinking and crowding proceeds, the world—certainly the free world—must learn better how to live cooperatively together to the mutual benefit of all peoples. * * *

Young people today are, of course, the heirs to the greatest fund of knowledge and the most opulent store of material advantages any generation ever received. The high school student has vastly more information at his command than any of the early settlers of this land, no matter how brilliant. The student lives longer and more comfortably than did medieval royalty, and moves about in an environment increasingly devoted to his convenience and enjoyment.

Yet we know that these things are not the essence of civilization. For civilization is a matter of spirit; of conviction and belief; of self-reliance and acceptance of responsibility; of happiness in constructive work and service; of devotion to valued tradition. It is a religious faith; it is a shared attitude toward people and living which is felt and practiced by a whole people, into which each generation is born—and nurtured through childhood to maturity.

Now no sudden, perfunctory transfer, from parent to child, of these enduring doctrines and traditions is possible, for their usefulness depends upon the degree to which they are understood and appreciated. Their inheritance is a matter of patient and loving instruction on the part of the parent, and of the slow but consistent spiritual and intellectual growth on the part of youth.

Growing in these concepts, drawing strength from these beliefs, our children understand, as we did not in our own youthful days, the need—now approaching the absolute—for peace with justice.

(Continued on page 35)

Research Needed in Education

By ROY M. HALL, *Assistant Commissioner for Research*

The following article is adapted from a speech Dr. Hall made in Chicago to the American Association of Colleges for Teacher Education, on February 11, 1960.

THE FUTURE of educational research is promising. I have several good reasons for saying so. First, past research has been important: it has helped identify types of students, types of teachers, types of schools, and the facilities, staff, and materials it takes to provide education. Second, an analysis of the research supported by the Cooperative Program of the Office of Education during the last 4 years shows that researchers are more concerned than formerly with the nature of learning and students' capacities and mental functioning. The research completed under this program proves that we can find out more about the relations of teacher education and teaching processes to human learning.

Every year we are getting more funds for the program and supporting more and better projects. Right now we are evaluating the program generally; thinking of training researchers, supporting more broadly conceived investigations, encouraging the development of projects that will bring the behaviorial scientists, subject-matter specialists, and general educators into a new working relationship; and experimenting with ways of presenting the findings and getting them to the educators who can use them. At the same time we are continuing to support research in its truest sense.

My work with the cooperative program has made me keenly aware of the need for further research. Although it would be naive for me to assume that I could tell you what to search for in education, I do feel that I might appropriately suggest some general subjects in which the unknowns are impeding the progress of education. Enough research has been done on the four subjects I shall mention to enable us to see the potential value of further study. It is about the implications of the additional research in these subjects that I want to talk for a few minutes.

1.

First, on the assumption that the true function of education is to develop to the fullest the intellectual abilities of the individual, we must intensify our efforts and inquire more deeply into the nature of learning: what takes place in a man when he learns, when his mind matures? Much of the research on learning up to now has been done on the assumption that teaching is largely a matter of transmitting information from the teacher to the learner, and the investigations have therefore centered on the best ways of transmitting knowledge or of motivating the learner to receive it. Even our testing has been done to determine which students have accumulated how much of what.

Bruner of Harvard, Guilford of Southern California, and many others have been searching for new dimensions in education. Dr. Guilford has given us a new description of the structure of the intellect and a reclassification of its operations. (His work is reported in the August 1959 issue of *The American Psychologist*, Vol. 14, No. 8.) If his theory is valid, it has far-reaching significance for education and the kinds of research we should be doing.

Let me explain. The assumption that teaching is primarily a matter of transmitting knowledge from teachers to students has led us to use the I.Q. score as a basis for classifying students into teaching groups, for admitting them to college, for organizing the multitrack plan, and for determining what to expect of the learner and when to expect it. If the ability to think critically, analytically, and creatively and to evaluate what is learned on the basis of its usefulness in solving problems is as important in learning as cognition and memory are, then our teaching methods may be ineffective or may even

lead to results antagonistic to those desired. Furthermore we may be selling the learner short by being satisfied with his accumulation and retention of facts and his success in presenting them back to us.

Getzels and Jackson at the University of Chicago and Taylor at the University of Utah have found that in some of our teaching practices we are either overlooking students' abilities or thwarting the development of them; that we may be making matters even worse by some of the experiments we are setting up to help students accumulate more knowledge more easily and more rapidly.

We know then that there is more to learning than simply gathering knowledge, that to be educated a man must have the ability to think, to make wise choices, to see relationships, and to reason from the known to the unknown. Only when education assumes the responsibility for developing all of these intellectual capacities will it fulfill its function: to enable man to direct his own development intelligently. Toward this fuller definition of learning we need to direct some of our research talent and energy so that our methods and materials will be consistent with the true purposes of education.

A second field of investigation is suggested by the renewed debate on the question: Should education emphasize adjustment or academic achievement? Those who emphasize adjustment to the extreme—and there are some who do—seem to forget that the effectiveness of group activity is determined by the quality and competence of the individuals in the group. The proponents of academic education accuse them of emphasizing adjustment so heavily that they produce only average and mediocre students. In turn, the proponents of adjustment education accuse the supporters of academic education of adhering so tightly to standards and molds that they allow their students no room to develop individuality. Ironically, each of these groups is probably right in its accusations, but very likely neither has correctly evaluated, by the stern tests of research, the results of putting its own theories into practice.

The Rockefeller Report on Education wisely reminds us that all individuals are different and that fortunately the strength of democracy lies in the diversity of the individuals who compose it. All of us would agree that the effectiveness of the individual in a free society is determined almost entirely by the extent to which he develops his abilities and expresses his point of view.

Edgar Friedenberg in his *Vanishing Adolescent* comments on the significance of competence in developing a stable identity. He says that school ought to be a place where you not only learn to be a scholar, a writer, a scientist, but also learn that "you are good at it and your awareness and pride in being good at it becomes a part of your sense of being you. . . . The greatest safeguard to any democracy is a continuing community of self-respecting young people who understand and accept their relationship to society. The basic unit of such a community is a stable self to respect."

Here, I suggest, is a fertile field for research. What are the unique abilities of the students? How does the individual perceive of himself? What are his aspirations, interests, and value systems? To what extent do our methods of teaching and persuading and punishing influence his self-confidence? To what extent do the preconceived expectations of teachers, parents, and community compel him to conform? to betray his individuality? to compromise his true person? to be less than his best in order to be like the group? or to efface himself because he cannot be what someone wants him to be?

It is unfortunate that we use tests almost exclusively to learn how well students measure up to some well-defined and restricted standard of expectancy and rarely to learn what students are like, what they want to do, and what barriers stand in the way of their developing into self-directing and self-respecting persons. Surely we need more and better tests—tests that teachers, parents, and students can understand and use to help them discover what each individual is like, what his capacities and developmental patterns are. As we build and administer tests and use their results, we need to keep uppermost in our minds the development of the individual, assuming that if we help him develop fully he will be a competent and effective member of a highly complex and free society.

A third subject in which research is needed is what I call the nonschool influences on the intellectual development of students. I am thinking here of the home, the gang or group of friends, the college campus. There is a great deal of talk and even criticism of what the school does to the student. Much research has been done on the results of various types of schooling; the influence of courses, school activities, and teachers' personalities on students; extent to which different types of programs determine the achievement patterns of young people. Recent research has reminded us that at best the school is only one of the many influences on intellectual development, and, at worst, that school influences and nonschool influences may be in direct opposition.

The findings of Havinghurst, Davis, Lewin, and many others suggest that children's group activities outside of school may be in conflict with organized school activities. Research in the sociology of the home leads us to wonder whether the home is not more responsible for students' compulsion to conform than the standardized program of the school is. There is increasing evidence of the extent to which the home reinforces the school's influences on the child in such matters as developing study habits,

learning to read, and acquiring cultural appreciation.

A recent investigation of a group of first-graders identified two influences that seemed to account for the differences between the child who could read and the one who could not. First, when the reader was between 3 and 4 years old, someone in his home had read to him a great deal; it apparently made no difference who it was, whether the mother, father, sister, brother, or maid. Second, one or both parents of the reader had determined that he was going to learn to read; and again it made apparently no difference whether the parents rewarded, coerced, punished, or what not, so long as they persisted in their determination that the child should learn to read. The investigators found no characteristic differences either in intelligence or in social and economic background between the children who could read and those who could not.

In his studies of school and college retention in Wisconsin, J. Kenneth Little found that the social, economic, and educational atmosphere of the home was a strong influence on a student's remaining in college.

C. Robert Pace of Syracuse University in a study of college campus influences is finding that the atmosphere of the college campus influences the intellectual development of the student in a variety of ways. His finding is understandable: the atmosphere on some campuses is stimulating and intellectually invigorating to students; on others it is only comfortable and tranquilizing.

I mention these research studies only as a reminder that as the community becomes increasingly interested in education, the intensity and the direction of nonschool influences on the educational development of students must be fully understood. Colleges of education can contribute to public and professional understanding; they can conduct some of the basic research on this general subject and experiment with ways of teaching their students how to judge such influences and how to use them when they themselves become teachers.

Fourth, the increased emphasis on the use of communications media in education has created a need for information on the relationship between subject matter and process in education. Most of the research in education and the relevant research in the behavioral sciences have dealt with the development and clarification of educational processes apart from the content of education. When, however, an effort was made to translate knowledge, ideas, and thought into a form which could be handled by films, teaching machines, and other media, it became obvious that students learn in many ways and that what they learn determines to some extent how they learn.

We need to ask, then, not whether films are effective, but rather, effective for what; not whether a color film is better than black and white, but in what learning situations it is better; what a teaching machine can teach, not whether it can teach.

If the findings of Guilford and other researchers are correct, we must deal with them in our theories of learning. Unless colleges of education become more concerned with the substance of education and the relation of substance to the process of learning, the teachers they are training are not likely to become so.

Colleges of education cannot leave the substance of education entirely to the academicians; they can take the initiative and, with the help of the academicians, find ways of relating the substance and the process of education. Surely such action is in their own interests: There can be no sound theories of education without consideration of both substance and process, and there can be no profession without sound theories.

NDEA Counseling and Guidance Training Institutes
Academic Year 1960–61

ABOUT 800 public and private secondary school teachers will attend counseling and guidance training institutes during academic year 1960–61 under title V, part B, of the National Defense Education Act. Twenty-two colleges and universities will conduct these institutes. Public school teachers will receive stipends of $75 a week plus $5 a week for each dependent. Tuition will be free for private school teachers, but they will not recieve stipends. For many of the teachers who attend, the institutes will be a means of completing academic requirements for State certification as counselors.

Six of the institutes will span the academic year:

Atlanta University, Atlanta, Ga.
The Pennsylvania State University, University Park.
University of Florida, Gainesville.
University of Minnesota, Minneapolis.
University of Missouri, Columbia.
University of Southern California, Los Angeles.

The less-than-full-year institutes will be conducted by—

Arizona State University, Tempe.
Boston University, Boston, Mass.
College of the City of New York, New York, N.Y.
George Peabody College for Teachers, Nashville, Tenn.
Michigan State University of Agriculture and Applied Science, East Lansing.
The Ohio State University, Columbus.
Oregon State System of Higher Education, Portland.
Purdue University, Lafayette, Ind.
San Diego State College, San Diego, Calif.
Teachers College, Columbia University, New York, N.Y.
University of Denver, Denver, Colo.
University of Georgia, Athens.
University of North Dakota, Grand Forks.
University of Texas, Austin.
University of Wisconsin, Madison.
Washington State University, Pullman.

SECONDARY SCHOOL MATHEMATICS IN TRANSITION

By DANIEL W. SNADER
Specialist for Mathematics

NEXT MONTH, in a second article, Dr. Snader will concentrate on the subject of how the teaching and administrative staffs of secondary schools and colleges can help each other, during this period of transition, to hasten the coming of a new era in secondary school mathematics.

THERE is greater activity in secondary school mathematics than we have ever seen before. We hear such statements as, "The old order is changing," "A new era is being ushered in," "Mathematical literacy is a *must* for living in today's world," and "The traditional mathematics must be pruned to make room for contemporary developments."

In the main, the meaning of such statements is clear to teachers and administrators taking an active part in the reorganization and development now going on. But there are many other teachers and administrators who find them puzzling and would be grateful for a briefing on the major reform movements in secondary school mathematics and for some light on the changes taking place.

Movements toward change

Some specific reform movements in secondary school mathematics are already well under way. I have chosen four major ones to describe here; they are representative of the others.

The *University of Illinois Committee* (UICSM),[1] which started its work in 1951, is now operating under a grant from the Carnegie Corporation. Jointly sponsored by the College of Education, the College of Engineering, and the Department of Mathematics, this committee has sought ways and means of correcting certain deficiencies in the conventional college preparatory mathematics. For instance, the meanings of fundamental terms like "variable," "equation," "relation," and "function," which are obscure in the traditional courses, needed to be clarified. Clarification required the introduction of some of the concepts of contemporary—often called modern—mathematics, such as the theory of sets, and the theory of relations and functions.

The UICSM program does *not* delete large segments of the traditional curriculum and replace them with topics from the more recently developed modern mathematics. The Committee considers skill in manipulative tasks a desirable goal but believes that the keynote in the teaching-learning process is *discovery* and that the language and symbolism used in the process should be clear and precise.

The program consists of four courses, one for each year of the secondary school. Gifted eighth-grade pupils as well as ninth-grade pupils are admitted to the first course. The four courses, including instructional materials for teachers, are now commercially available at the University of Illinois Press, Urbana, Ill.

A glance below at the topical contents of the UICSM courses and a comparison of them with the topics usually listed in traditional courses on the same grade levels will give you some notion of the changes being made. A more detailed study of the UICSM courses themselves is recommended.

FIRST COURSE. Distinction between numbers and numerals; real numbers; principles of real numbers (associativity, commutativity, etc.); inverse operations; relations of inequality; numerical variables ("pronumerals"); generalizations about real numbers; notation and some concepts of the algebra of sets; solution of equations, linear and quadratic; solution of "worded" problems; ordered pairs of numbers; graphing equations and inequations.

SECOND COURSE. Sets and relations; linear and quadratic functions; systems of linear equations; measures of intervals, arcs, angles, and plane regions; elementary properties of angles, polygons, and circles.

THIRD COURSE. Mathematical induction (generalizations, hereditary properties, recursive definitions, progressions, Σ-notation); exponents and logarithms (continuity and the limit concept, geometric progressions, the

[1] See the report on the UICSM in *Purchase Guide for Programs in Science, Mathematics, and Modern Foreign Languages*, Council of Chief State School Officers, Ginn and Co., 1959, p. 262.

binomial series); complex numbers (field properties, systems of quadratic equations); polynomial functions (the factor theorem, synthetic division, curve tracing).

FOURTH COURSE. Circular functions (winding functions, periodicity, evenness and oddness, monotoneity, "analytical trigonometry" rather than "triangle solving," inverse circular functions); deductive theories (abstraction of postulates from a model, deduction of theorems from these postulates without reference to a model, reinterpretation of the theory to yield information about other models); analytical geometry.—*Purchase Guide*, p. 262.

The Commission on Mathematics was established in 1955, when the College Entrance Examination Board (CEEB) appointed a group of mathematicians and secondary school and college teachers to examine the secondary school program in mathematics and make recommendations for improving the curriculum for college preparatory students. The colleges were already modifying, modernizing, and improving their mathematics programs, and their changes suggested improvements on the secondary school level too.

The major proposals of the Commission have been summarized in nine points:

1. Strong preparation, both in concepts and in skills, for college mathematics at the level of calculus and analytic geometry.

2. Understanding of the nature and role of deductive reasoning in algebra, as well as in geometry.

3. Appreciation of mathematical structure ("pattern") as it occurs, for example, in properties of natural, rational, real, and complex numbers.

4. Judicious use of unifying ideas, such as those involving sets, variables, functions, and relations.

5. Treatment of inequalities along with equations.

6. Incorporation with plane geometry of some coordinate geometry, and essentials of solid geometry and space perception.

7. Introduction in grade 11 of fundamental trigonometry (centers on co-ordinates, vectors, and complex numbers).

8. Emphasis in grade 12 on elementary functions (polynomial, exponential, circular).

9. Additional alternative units for grade 12 involving *either* introductory probability with statistical applications, *or* an introduction to modern algebra.—*Purchase Guide*, p. 261

The School Mathematics Study Group (SMSG), which is financially supported by the National Science Foundation, is a national body organized to improve the teaching of mathematics in the schools throughout the country.

The Study Group has had four projects under way since 1959. With the possible exception of one, they seem concerned with both the gifted and the average child.

The first project is a curriculum study for grades 7 and 8. Experimental units written as part of the study are now being tried out in a large number of classrooms.

The second project, also a curriculum study, covers grades 9 through 12. It has already produced experimental textbooks, which are being tried out in many schools throughout the country. In both content and terminology, these books are somewhat similar to the instructional materials used in the UICSM program.

The third project is producing a series of monographs on various phases of mathematics. These monographs will be written by outstanding mathematicians—for the mathematically talented high school pupil.

The fourth project is preparing textbooks, study guides, and other materials to aid teachers in improving their preparation in mathematics. Study guides in modern algebra, and booklets dealing with set theory and geometry are ready for distribution.

In addition to the materials prepared under these four projects, the Study Group will produce materials for the less able student as well. It will also extend its program downward to study and prepare materials for use at the elementary school level.

Anyone wishing to see the materials produced by the SMSG should write to its director, E. G. Begle, Drawer 2502A, Yale Station, New Haven, Conn.

The Minnesota National Laboratory for the Improvement of Secondary Mathematics, under the direction of P. C. Rosenblum, professor in the mathematics department, Institute of Technology, University of Minnesota, scientifically tests teaching materials and evaluates them for the SMSG. It makes detailed technical reports on procedures and results; in these reports the schools can find guidance for their decisions on whether to use the tested materials in their own classes. At present the Laboratory is evaluating the 7th and 8th grade materials produced by the SMSG, and the 9th grade materials produced by the UICSM.

The Laboratory is part of the Division of Instruction, headed by Farley D. Bright, Minnesota State Department of Education. Further information on its work can be had by writing directly to the Laboratory, 301 State Office Building, St. Paul, Minn.

Readers who wish information on other interesting and promising movements in secondary school mathematics should consult the following sources:

Concepts and Structure of Mathematics, mathematics staff, College of the University of Chicago, University of Chicago Press, 1954.

Recommended Outline of Courses, Committee on the Undergraduate Program, Mathematics Association of America. Write to H. M. Gehman, University of Buffalo, Buffalo 14, N.Y.

Advanced Placement Program Syllabus, College Entrance Examination Board, 425 W. 117th Street, New York, 1958.

Experimental Program in Geometry and Algebra, Ball State Teachers College, Muncie, Ind. Write to Charles Brumfiel.

"Report of the Secondary School Curriculum Committee of the National Council of Teachers of Mathematics," *The Mathematics Teacher*, February 1958, pp. 146–148.

Mathematics for the Junior High School, University of Maryland Mathematics Project. Write to John R. Mayor, College of Education, University of Maryland, College Park, Md.

Need for reform?

To those who ask, "Do we really need to reform our secondary school mathematics program?" I can only answer: First, look at the many uses we have for mathematics today, at our great need for it; then look at our present offerings in the traditional program.

The need. If our high schools are to fulfill their promise to society, they must take into account the diverse mathematical needs and abilities of students. Every student in the secondary school needs some kind of mathematical experience. The prospective scientist or engineer needs all the mathematics he or she can get before entering technical courses in college, university, or training school. Students who plan to major in other subjects in college will find that most fields use a great deal of mathematics today—much more than they did a generation ago.

For example, a student of social studies must have a good grasp of statistical methods and probability theory. Majors in business administration are required to know a great deal about high-speed calculating machines and data processing. Regardless of the work a young person hopes to prepare for, he will need, as generations before him never needed, an understanding of and a facility with mathematics.

Many new fields are opening up that call for men and women well prepared in mathematics. For example, we are told that each new computing machine will require the services of 10 persons well prepared in mathematics; and estimates say that we will need about 50,000 newly trained persons for this purpose alone within the next decade.

There seems no question about it: every high school student capable of studying 3 or 4 years of mathematics should be strongly advised to do so.

The traditional program. The traditional curriculum in high school mathematics was developed many generations ago—as a college preparatory program. Since then, the "general mathematics" movement has attempted to provide for the needs of those students who would not be going to college. Today we find the traditional courses unrealistic—out of touch with the needs and demands of our rapidly changing society.

But we should not blame anyone in particular for this cultural lag. The pure mathematicians have been busy developing new mathematics, and the teachers of mathematics have been busy trying to cope with educational problems. What is more, the contemporary, or modern, mathematics is developing so rapidly that only a small portion of it can be mastered by any one person.

However, the new developments have made some of the traditional content obsolete and have also reduced the importance of some topics and increased the importance of others. Some new subjects are evolving, and parts of them appear to be suitable for study in the high schools.

Meaning of modern mathematics

To explain the meaning of the term "modern mathematics," I want to say that it involves both a point of view and new subject matter. Let us look briefly at both.

I must remind the reader that there is no sharp division between what we call traditional mathematics and what we call modern, or contemporary, mathematics. There is no discontinuity in the growth of mathematical ideas; what is new today grew out of the old, and what will be new tomorrow is already taking root in the mathematics of today.

EXAMPLE 1. When you studied algebra, several decades ago, you factored the difference of two squares, a^2-b^2, as $(a-b)(a+b)$. You were probably told that a^2+b^2 could not be factored; and it is true that it cannot when only rational numbers are used. But when complex numbers are considered, then a^2+b^2 can be factored, into $(a+bi)(a-bi)$. Thus, when you give attention to *mathematical structure*, you extend the traditional knowledge of "factorability" to cover a^2+b^2 whenever complex numbers are the domain of the variables.

EXAMPLE 2. When you studied algebra, a *variable* was quite loosely defined as a number which changes, or as a symbol to which various values can be assigned. Today we define *variable* more carefully: as a symbol (x, y, z, etc.) which represents (holds the space or place of) any one of a specified set of numbers or "things" (not necessarily numbers).

Do you recall your astonishment when as a high school pupil you solved a quadratic equation based on some "worded" problem—and found that one of the answers (roots) had to be rejected, while the other, for some reason unknown to you, was accepted?

For instance, suppose you were to find the length and width of a rectangle whose area is 54 square inches and whose length is 3 inches more than its width. You would say: If w represents the number of inches in the width, then $w+3$ represents the length; and $w(w+3)$ = the area, in square inches. Hence—

$$w(w+3)=54$$
$$w^2+3w-54=0$$
$$(w+9)(w-6)=0,$$
$$\text{or } w=6;\ w=-9.$$

The second answer is to be discarded.

But why is -9 unacceptable? Obviously, if the replacements for the variable w are confined to positive real numbers, then -9 is not a member of the specified set. Here the concepts of *set*, as well as of *domain* and *range*, which are introduced into the newer courses, will aid pupils in interpreting results such as these.

EXAMPLE 3. What is the sum of 9 and 6? Is it always recorded as 15? Does the sequence of symbols 1 and 5 in 15 always refer to $1(10)+5$?

In our system of natural numbers $9+6=15$, meaning $1(10)+5$. But we are also familiar with a system of addition where the "facts" are quite different. For instance, in a certain system we use every day, these are some of the sample operations:

a) $7+8=3$ *d*) $3-8=7$
b) $6+10=4$ *e*) $5-6=11$
c) $5+9=2$ *f*) $2-9=5$

But how is this? Actually, these masquerading "number facts" are the results of adding *hours* (on the face of a clock), not *numbers*. Thus—

a) $7+8=3$ *means* 8 hours after 7 o'clock is 3 o'clock;
b) $6+10=4$ *means* 10 hours after 6 o'clock is 4 o'clock;
c) $5+9=2$ *means* 9 hours after 5 o'clock is 2 o'clock;
d) $3-8=7$ *means* 8 hours before 3 o'clock is 7 o'clock;
e) $5-6=11$ *means* 6 hours before 5 o'clock is 11 o'clock;
f) $2-9=5$ *means* 9 hours before 2 o'clock is 5 o'clock.

Remember, we are here manipulating with hours, not numbers. What principle is involved? Let us see.

Note that 12 hours counts as zero hours. Therefore, when the ordinary addition of hours on the clock produces an answer greater than 12, the sum recorded is first reduced by 12. For instance, the sum 3 in example *a* is not the ordinary sum of the numbers 7 and 8, but is the ordinary sum, 15, *less* 12. Also, the difference 5 in example *f* is not the ordinary difference of $2-9$ (or -7), but is 12 *more*, or 5.

These examples illustrate operations in arithmetic called *addition* and *subtraction, modulo 12*. Similar operations may be performed in other modular systems, each having some other suitable integer as its modulus. Secondary school pupils enrolled in the new experimental programs are now studying the structure, properties, and notations of various systems of numeration, not only those commonly associated with everyday arithmetic. They are, for example, getting better acquainted with a system of numeration in which 2 is the base. This system has great practical importance because it is the system used by the high-speed digital computers, often referred to as electronic "brains."

The tables for *addition* and *multiplication, modulo 2*, are shown here:

+	0	1
0	0	1
1	1	10

X	0	1
0	0	0
1	0	1

It would be an interesting exercise for you to learn to express some ordinary arithmetic numerals as numerals having a base 2; also to do some simple computations with numerals to the base 2, and then to convert your answers into our ordinary decimal notation (base 10). You may find yourself in a position not too unlike that faced by a child learning for the first time to compute in ordinary arithmetic. Try it!

EXAMPLE 4. In 10th grade geometry formal deductive proof is now frequently based on a shorter sequence of theorems. Concepts of solid geometry are taught as extensions of their counterparts in plane geometry. Proof, usually confined to geometry courses, is now being given much more attention than hitherto in algebra courses. Analytic geometry (algebraic geometry) is being introduced and used in establishing proofs of theorems and original exercises usually handled by Euclidean methods. The usual bases of proof (definitions, assumptions, and undefined terms) are now being studied and applied to nongeometric situations—everyday life situations—which call for analysis and proof.

EXAMPLE 5. In trigonometry there is much less need now for the logarithmic solution of triangles and computational aspects of the subject. In fact, this is a good illustration of traditional subject matter which has become *obsolete*.

Practical problems of trigonometry now call for solutions by vectors and their components instead of the traditional solution of triangles; also, modern computing devices, such as digital computers, are displacing logarithmic computations. The emphasis is now being placed on the analytical phases of trigonometry. In the evolving mathematics curriculum, trigonometry is being taught less frequently as a separate course; but important phases of it, such as rectangular coordinates of points (x, y) and polar coordinates of points (r, Θ), vectors, complex numbers, sine and cosine laws, addition theorems, identities, equations, circular functions, and exponential functions—as well as the basic trigonometry of right and obtuse triangles—are now being treated in appropriate places throughout the sequence of courses in secondary school mathematics, rather than in isolation in a single course.

EXAMPLE 6. Many of the new applied problems in mathematics, drawn from physics, biology, and social science, are solved by use of probability theory and statistical methods. Hence, an introduction to statistical thinking is now being recommended for informal study in the 9th grade, and a formal unit on the mathematical theory of probability and statistical inference in the 12th grade. Although this 12th year course is relatively new for secondary schools, it is being favored by those who have tried out the CEEB instructional materials for this course.

EXAMPLE 7. To apply some of the modern concepts of mathematics in secondary school courses, the teacher must understand the concepts of sets and must use set language, symbolism, and methods. The following list of examples should give the lay reader an idea of the meaning and simple uses of sets:

1. A *set* is any collection of numbers, objects, or things so specified that we can tell without question whether a given number, object, or thing belongs to the set. For example, let us consider 2 sets of numbers:

The set *S*, consisting of the counting numbers 1 through 8, is expressed in symbols as—

$$S=\{1, 2, 3, 4, 5, 6, 7, 8\}$$

The set *T*, consisting of the doubles

of the numbers in set S, is expressed in symbols as—

$$T=\{2, 4, 6, 8, 10, 12, 14, 16\}$$

2. The *intersection* (symbol $\cap$) of set S and set T is another set (call it W), whose elements are in both S and T. Here W is a proper subset of S and T. Expressed in symbols,

$$W=\{2,4,6,8\}$$

$$W\subset S \text{ and } W\subset T$$

3. The *union* (symbol $\cup$) of set S and set T is still another set (call it X), whose elements are in S or in T, or in both. Expressed in symbols,

$$X=\{1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16\}$$

4. If a set (call it K) has no elements, it is called the *empty* or *null* set, designated by $\emptyset$:

$$K=\{\ \}=\emptyset$$

The set of all perfect squares ending in *3* is a *null* set. Why? Are there any numbers which satisfy the stated conditions, namely, that they be *perfect squares* and *end in 3?* If not, then the set is "empty," has no elements, and is called the *null* set.

5. The *solution set* of an equation or inequality is the set of numbers from a specified set which, when used to replace the variable or variables, makes the sentence (the equation or inequality) true.

For example, let $y+3=7$ and $3y-2<7$ be two algebraic sentences. These sentences cannot be considered true or false, but rather as "true of" or "false of" a certain set of numerical replacements for y. *The set of numbers considered must be specified.* If the set consists of positive and negative integers and zero, then, if y is replaced by 4, the sentence $y+3=7$ is a true one. Since 4 is the only member of this particular set which, by replacing the variable y, will make the sentence true, we say the *solution set* of the sentence is—

$$\{4\}$$

And when the second algebraic sentence, $3y-2<7$, is handled in a similar manner, its solution set is found to be—

$$\{\text{any number of the set which is less than 3, i.e., the set } \{2, 1, 0, -1, -2, -3, \ldots\}\}$$

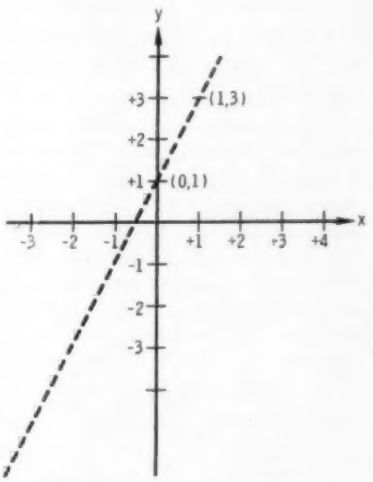
These ideas can also be expanded to apply to sentences in *two* variables, such as—

$$y=2x+1 \text{ and } y>2x+1$$

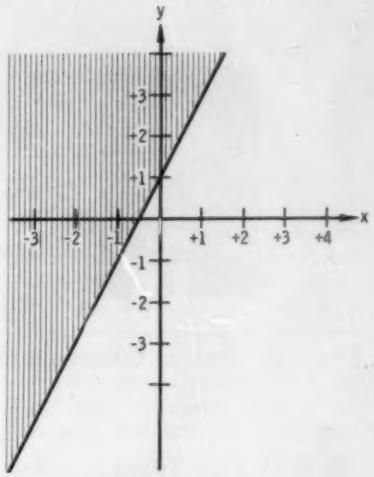
Let us now consider *ordered number pairs* (x, y) which will make the sentences true.

In $y=2x+1$, if the x replacement is 0, then, to make the sentence true, the corresponding y replacement must be 1; if x is 1, then y must be 3; and so forth. But, in $y>2x+1$, the x replacement must be so chosen from the *universal set* (the entire set under consideration, including positive and negative numbers and zero) that when this number replaces the variable x, then the corresponding replacement of the variable y makes the statement $y>2x+1$ true. If $x=0$, y must be greater than 1; if $x=1$, y must be greater than 3; and so forth.

When the sets of ordered number pairs (x, y) are plotted as *points* on a graph, they appear as follows:



The incomplete *straight line* graph of $y=2x+1$, in which the solution set is infinite.



The incomplete *half-plane* graph of $y>2x+1$, in which the solution is infinite.

These few examples may give the lay reader some elementary ideas of the new language of *sets*, and the versatility of its use in treating topics of traditional subject matter and extensions of them. This brief account offers only a fleeting glance at the changes in terminology, symbolism, and uses which the language of sets has brought about; and I advise the lay reader to take a closer look at the new subject matter by studying the instructional materials produced for secondary schools by the organizations mentioned early in this article.

COMMUNICATION is not merely the desire and the responsibility of the scholar; it is his discipline, the proving ground where he tests his findings against criticism. Without it his pursuit of truth withers into eccentricity. * * * He needs the company of fresh minds to whom he must explain things from the beginning.

Edmund S. Morgan
Professor of History
Yale University

Saturday Review, Jan. 23, 1960.

SCHOOL PLANNING for QUALITY and ECONOMY

By JOHN L. CAMERON, *Chief, School Housing Section*

TWO MAJOR FORCES, both extraordinarily vigorous, are at work in education in this country today. They are the pressure to reduce the cost of education and the pressure to improve the quality.

At first glance these two pressures appear to be diametrically opposed. A more careful analysis, however, reveals that through careful planning the objectives of both can be accomplished. What is this magic formula that will permit us to "have our cake and eat it too?"

There is no magic formula about it. It requires only the willingness of responsible school officials and the public to put into practice some of the basic principles of school organization and administration with which most of us have been familiar for years.

Basic principles underlie the six steps I want to recommend here to State and local officials working at the highly complicated job of cutting costs and raising quality.

1. Reduce the number of school districts

Even though we have reduced the number of school districts in this country from approximately 63,000 in 1953–54 to about 45,000 now, we still have many small school districts. The Committee for Economic Development, in its publication *Paying for Better Schools*, recommends a further reduction to approximately 10,000.[1]

During the school year 1956–57 more than 90 percent of the public school systems in the United States enrolled fewer than 1,200 pupils, and approximately 58 percent enrolled fewer than 50 students.[2]

In any combining of districts, officials should make sure that all schools are brought up to a level equal to that of the best schools, or even higher. Merger of school districts cannot be justified on the basis of a leveling out process that improves the quality of education for some children and impairs it for others.

The merging of school districts should result in the following benefits:

★ Improved educational opportunities for a large part of the student population.

★ A broader and more nearly equalized base for financial support.

★ Reduced administrative costs in many districts. Note: Very likely costs will not be reduced by combining large districts as the administrative staff required after merging will probably be as large as the total of the districts before they were merged.

★ Simplified long-range planning—particularly along the fringe areas of a growing city.

★ Improved plant maintenance. Since fewer maintenance men will be needed for a large school than for several small schools, the combining of schools will make money available to employ men skilled in plumbing, heating, electrical, painting, and other trades.

★ Simplified and economical transportation of pupils. In numerous districts the school bus passes by a school in one district as it takes pupils to a school in another district, the one in which they live. This is costly not only in money but in time.

★ Reduced cost of providing new school facilities.

★ Reduced costs of operating school buildings.

2. Reduce the number of small schools

All recent significant studies have indicated that large schools can offer better educational programs at a more reasonable cost than small ones. This is particularly true of secondary schools.

The greatest value to be gained from carrying out this suggestion is in the improved educational opportunities to boys and girls. Even though the small high school has a greater cost per pupil than the larger one, it is pretty much limited to offering college preparatory work, whereas the large high school has the potential of doing a better job of college preparatory and of preparing the large percentage of the high school graduates who do not go to college. A secondary value, but an important one, is the savings in capital outlay and in operating costs.

In consolidating schools, officials must exercise mature judgment to keep such mergers within practical limits. If geographical or other conditions make it necessary to maintain a small school, district officials should make a determined effort to enable it to offer the best possible opportunities to the pupils who attend it. Such a situation illustrates

[1] Committee for Economic Development, *Paying for Better Schools*. New York, the Committee, 1959, pp. 68–69.

[2] *Paying for Better Schools*, p. 7.

again the importance of having a broad base for financial support of the schools.

3. Plan the organization of the schools and the building program to provide for future needs

An outstanding educational consultant recently said, "The time to do a survey is when you think you don't need it."[3] His statement illustrates the importance of having a definite plan prepared before you are confronted with the necessity of taking action.

Long-range plans should be reviewed frequently and modified to take into account changes in conditions which were not foreseen in the original planning. Buildings should not be constructed that will not be needed when the long-range plans have been realized. More money has probably been spent on buildings that should not have been constructed or were built larger than necessary than on so-called frills.

It is important to secure school sites in areas of predicted population growth well in advance of the actual need of the building. Proper sites can be selected if an adequate job of long-range planning is done. After an area has been developed, school sites suitable to accommodate an adequate educational program are expensive and often difficult to secure.

4. Construct buildings of such quality that maintenance, operation, and replacement costs will be low

It is a very naive person who, in seeking economies in school construction, looks only at the initial cost of the building. Economy should not be confused with cheapness nor low initial cost with economical construction. The criterion for measuring economy should be the cost of the school plant over its lifetime to render maximum value for educational purposes.

A building of poor quality will be expensive to maintain, and the useful life of the building will be decreased. If it does not adequately accommodate the instructional program the cost of instruction will be increased, and the quality of the educational program will be diminished.

5. Develop an adequate maintenance program

Students can learn better and teachers can do a better job of teaching in an attractive, well-maintained environment. Good maintenance helps keep a healthful and pleasant environment for more productive learning and saves money in extending the time before major repairs or replacements must be made. It is foolish to build a million-dollar building and give it five- and ten-cent care.

A maintenance program, adequately staffed and equipped, should be developed and the jobs to be done regularly scheduled. Ample allowance should be made for emergency maintenance.

6. Schedule activities to get maximum utilization of resources

School officials can make greater use of their resources, including staff and property, by scheduling activities in every teaching station during the greater part of the school day, by extending the school day or school week, and by conducting adult education courses in the building during evening hours. Many schools are successfully using their buildings throughout the year by offering summer courses for pupils behind in their work, for advanced pupils, and for those who want to take courses they cannot get in their schedules during the regular school year.

Several school systems have tried the year-round plan, but most of them have abandoned it as impractical.

The School-Building Commission of the American Association of School Administrators, in the book *Planning America's School Buildings*, has the following to say regarding the year-round school.

> Numerous approaches will be made to adding new dimensions to the educational program of the future, but perhaps none will be more effective than that of extending instruction to a year-round program. Such an approach is sensible and economically sound. The school building already exists and its operation is under way. The teaching staff, which is by all odds the community's most important asset, is already mobilized. The expenses of general control, involved for the most part in administration, and fixed charges continue whether the school is in operation or has its doors closed for a long vacation period.
>
> Operating the schools on the basis of a staggered enrollment for the purpose of reducing cost would not add any quality to the educational program. This particular experiment has been tried again and over again, and there are grave doubts as to whether it would result in any worthwhile financial savings. So, we may not reasonably anticipate that much attention will be given to the 12-month program with a staggered enrollment other than an occasional discussion in magazines and newspapers, generally carried on by people who are overly concerned about reducing taxes.[4]

THERE are many other practices that, if followed would result either in economy or in improving the quality of education. I have mentioned only those that would in some degree result in both.

Rapid advances in the development of new building materials and techniques and in improved design dur-

(*Continued on p. 35*)

[3] W. L. Lathan, educational consultant, Division of School Planning, North Carolina State Department of Public Instruction at a conference in Winston Salem, Jan. 12, 1960.

[4] American Association of School Administrators, *Planning America's School Buildings*, the Association, Washington, D.C., 1960, p. 14.

The 1960 Census and Its IMPLICATIONS FOR EDUCATION

By JOEL WILLIAMS,
Chief, Statistical Operations Section

ANYONE who casually turns through the Census volumes, containing page after page of figures, must be impressed by the scope of the endeavor they represent. When he looks behind the numbers he can obtain a vivid insight into life in the United States and its historical development. He can study the westward march as one State after another is admitted; the characteristics of the pioneers—first the large numbers of unattached men, then the settler families—and finally the native second generation. He can study the immigrant waves—the Irish in the 1840's and 1850's, the Germans in the 1870's and 1880's, and the eastern Europeans and Italians in the two decades before World War I. He can observe the gradual development of our country, from an agrarian economy with seven out of ten gainfully occupied persons engaged in agriculture in 1820 to an overwhelmingly industrial economy with one out of ten in agriculture in 1950.

At one time or another very likely you have based some statement on information collected in the census. How often have you mentioned the number of persons in your State, county, city, or local community? Perhaps you have commented on the increasing numbers of people attending college, the increasing numbers of elderly people, the average income of the population, the extent of employment or unemployment, the migration of people from certain areas to other areas, or the shift of employment to occupations unknown a generation ago.

On April 1, the 18th Decennial Census will be initiated. This Census will represent the largest statistical endeavor and the most massive collection of facts in the history of our Nation. About 170,000 persons will be employed to assist in collecting data from 180,000,000 persons in 60,000,000 households. The entire area of the United States has been subdivided into enumeration districts, and for each a map has been prepared. Larger maps showing combined enumeration districts have been prepared for intermediate supervisors called crew leaders and, in turn, even larger maps combining crew-leader districts have been drawn up for district supervisors.

In addition to the Census of Population, in which the individual will be asked between 25 and 35 questions on his personal characteristics, a Census of Housing is to be taken concurrently, in which about 35 questions will be asked about each dwelling.

The Census Questions

Although the questions used in previous censuses form the framework upon which the current census is based, the 1960 census is not simply a repetition of a previous one. For several years, the Census Bureau staff has been evaluating the items used in the past, developing new questions based on changes in social and economic conditions and requests from users, and testing new ideas. Various types of committees have been convened to study these proposals—committees of users, technical advisory committees, and Federal interagency committees. Representatives of the U.S. Office of Education have worked with the Census Bureau in planning.

Before the Bureau decided what questions to include, it tested all questions in a "trial census" in which all of the conditions of the actual undertaking were simulated. The items selected for inclusion in the 1960 Census of Population are as follows:

For the total population:
- Name
- Relationship to head of household
- Sex
- Color or race
- Month and year of birth
- Marital status (single, married, widowed, divorced)

For the sample households:
- State or country of birth
- Mother tongue (of foreign born)
- Country of birth of parents
- Length of residence at present address
- Migration status (residence 5 years ago)
- Highest grade of school attended
- Completion of grade (Yes—No)
- School attendance now (persons 5 to 34 years old)
- Public or private school
- Date of marriage
- Children ever born (for women ever married)
- Employment status and hours worked
- Occupation, industry, and class of worker
- Place of work
- Means of transportation to work
- Weeks worked in 1959
- Veteran status (for men)

Education Questions

The education questions this year are in the "sample" segment of the schedule. Every person in one out of every four households will be asked the questions on education along with a number of other questions (see the list above). The results when published, however, will have been inflated to reflect characteristics of the total population. The questions shown in the illustration of the schedule are numbered P14, P15, P16, and P17.

Education questions included in the census should measure the status of the population, or large segments of it, at some point in time and should be repeated in censuses for a number of decades so that changes in the national status can be measured. The two basic education items, school enrollment of the school-age population and educational attainment of the adult population, meet these criteria.

Historically, education questions can be traced back through each census to 1840. The school enrollment series is unbroken back to that date; educational attainment was added in 1940. Since the national illiteracy rate was down to 4.3 percent by 1930, a broader and more discriminatory question—on highest grade of school completed—was developed for the 1940 Census to replace the question on literacy that had been asked during the previous century. A study of the data based on this question and further experimentation during the decade revealed some overstatement of grade completed, especially for students still in school. Consequently, in 1950 and again in 1960, this question was divided into two parts:

a. *What is the highest grade of school he has attended?*

b. *Did he complete this grade?*

By asking grade attended rather than grade completed, it is possible to obtain the grade level of attendance of persons still in school, that is, the number in elementary school, in high school, and in college.

Another question on school enrollment has been added in 1960. Recent increases in private school enrollment led the Office of Education to request and the Bureau to add a question on whether enrollment was in public or private (including parochial) school.

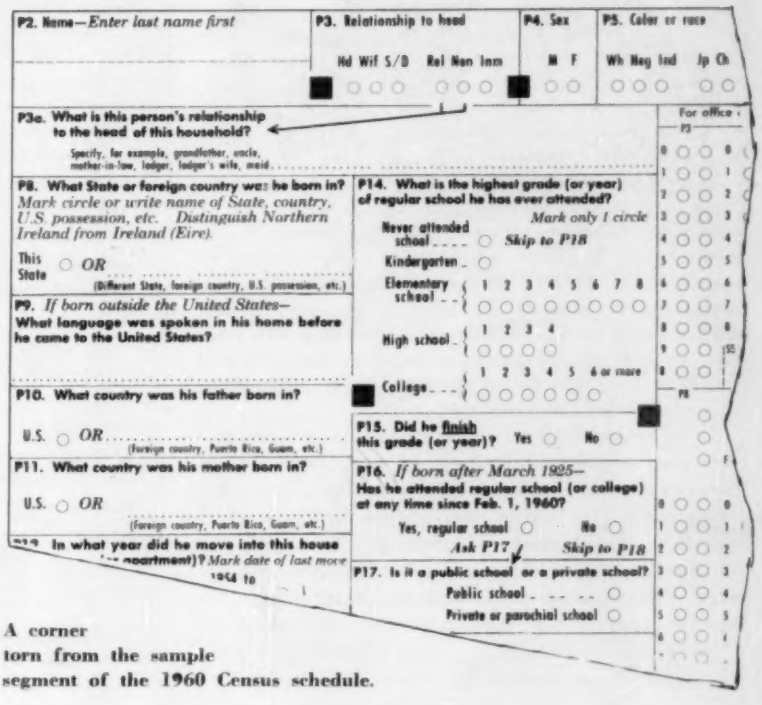
In addition to direct questions on education, there are some items not readily apparent as pertaining to education. For example, in classifications on occupation and industry, data will be published for teachers, by elementary and secondary levels, and for college professors and instructors by about one dozen major types of subjects taught.

Questions on education in the census have led many people to ask: "Why do the Office of Education and the Census Bureau both collect statistics on education? Isn't there an overlapping of functions?"

As a matter of fact, there is very little overlapping. The Office of Education collects statistics on an institutional basis from colleges and universities, school districts, or schools; whereas the Census Bureau collects information on the characteristics of individuals. The data the Office collects in its recurrent statistical program reflect the status and condition of education throughout the Nation on such items as teaching staff, enrollment by grade, course offerings, condition of school plant, and finances. The census education data, on the other hand, reflect social characteristics. They are used in cross-classification with other demographic, social, and economic characteristics for research purposes.

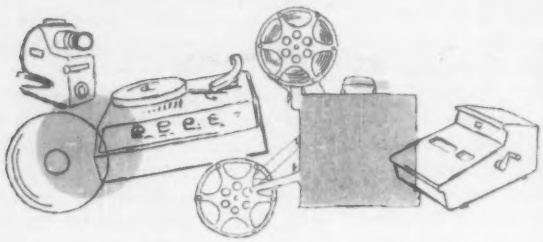
In the 1960 Census, the design of the sample on a household basis makes it possible to relate personal to family data, the educational status of children to that of their parents, and the education of husbands to that of their wives. Education can be used as a control variable in a great number of cross classifications with other characteristics.

(*Continued on p. 33*)



A corner torn from the sample segment of the 1960 Census schedule.

PART I—THE CHANGING SCENE



TECHNOLOGY IN THE CLASSROOM

CHALLENGES TO THE SCHOOL ADMINI

By GENE C. FUSCO, *Specialist, School and Community Relations*

Dr. Fusco.

ACCELERATING FORCES are placing the American educational system under increasing stress: (1) Rising birth rates are leading to rising enrollments, (2) expanding knowledge in many fields is modifying the curriculum, and (3) advancing technology is influencing the instructional process.

As a consequence of these developments, the school administrator is faced with increased tasks and mounting pressures. As he discharges his chief responsibility—improvement of instruction—he finds his problems compounded by a continuing teacher shortage, the need for more classrooms, and the heavy burden on current sources of school revenue. In addition, the public, more aware than ever that education is our first line of national defense, is expecting more of the school administrator.

Of the myriad tasks which the administrator faces, perhaps none is more challenging—or more urgent—than assessing the role of new educational media in improving instruction. The instructional process is the heart of education. Developments in communication reveal possibilities for making this process more effective and efficient. Indeed, such improvements may come, for basically education is institutionalized communication.

Instructional materials give shape and substance to the school curriculum, control its content, and vitally affect the teaching-learning process. "Without appropriate materials, a modern educational program is an impossibility. Upon the superintendent falls the task of *getting* better materials and *making them available* to teachers."[1] But the school administrator cannot effectively discharge these critical responsibilities unless he keeps abreast of trends and informs himself about impending changes in instructional materials.

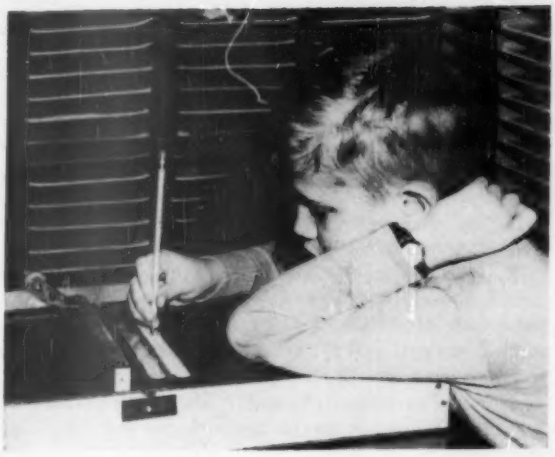
In cooperation with his staff and teachers, alert school administrators will derive implications of the new media for the instructional process and consider ways and means of adapting them to their school program.

New technological developments in media of communication have extended the meaning of the term, "instructional materials." A few decades ago, the "older" medium—print—was supplemented by "audiovisual" materials, such as motion pictures, filmstrips, slides, disk recordings, and radio. These materials, which do not depend primarily on the printed word but appeal to one or more of the senses, offered classroom teachers possibilities for accelerating and enriching the learning process.

More recently, "newer" media in the form of video and audio tape, language laboratories, and automated devices have revealed still other instructional possibilities. Many believe that carefully designed and integrated learning

1. AASA Staff, "Tools for Teaching," *NEA Journal*, National Education Association, Washington, D.C., December 1959, p. 51.

INISTRATOR



materials—a unified "package" of printed and AV media—can serve as more than adjuncts for the teacher. If they are used on the basis of the teaching task of the moment and the special contribution to learning each can make, they can serve the classroom teacher as a variety of teaching tools.

Since World War II, there has been a tremendous expansion of the audiovisual field. Signs of rapid growth appear in the upsurge of local, State, and national AV associations; in AV textbooks and periodicals; in AV departments in local school systems; and in research studies dealing with this subject. The AV movement in education has grown to a point where an estimated 20 million

dollars per year is spent on materials, equipment, and services, exclusive of salaries.[2]

The accelerating rate of research in AV instruction in the past decade is seen in the 320 references given on this subject in the 1960 edition of the *Encyclopedia of Educational Research:* the 1950 edition contained only 120 references. Most of the listed sources represent major research studies, largely supported by grants from agencies, philanthropic funds, and the military services.

Although the AV field is growing rapidly, on a nationwide basis the utilization of new tools for learning is rather limited. The survey conducted in 1955 by the National Education Association on AV education in urban school districts revealed that, although financial support for this purpose had nearly doubled in the preceding 8 years, the median amount spent on equipment and materials was only 65 cents per pupil. In almost three-fourths of the urban districts reporting, the amount was less than $1 per pupil, a figure far below the expenditure recommended by many educators.

Whether teachers in a school system effectively use a variety of instructional materials depends on many factors, not the least of which is the quality of administrative and staff leadership. The following statement by the Educational Policies Commission on the possible causes of the underdeveloped use of a particular instructional tool—motion pictures—has implications for the school administrator. "The slow acceptance of audiovisual material—the average teacher still unprepared to use it, and the average school system still poorly equipped for it—is not the result of any well-founded distrust of the educational potential of motion pictures. It seems to be, rather, a combination of inconvenience of utilization, perhaps a certain condescension, and a general unawareness of significant research findings".[3]

Mass Instruction Through New Media

During the past few years, the upsurge of interest in education has stimulated studies in a number of subject-matter fields. These inquiries range from research conducted at the local level with small staffs and modest budgets to massive long-range studies supported by millions of dollars.

The large studies, in particular, though also inquiring

2. William H. Allen, "Audio-Visual Communication," *Encyclopedia of Educational Research,* 3d edition, Macmillan, 1960, p. 15.
3. Educational Policies Commission, *Mass Communication and Education,* The Commission, National Education Association, 1958, pp. 87–88.

into the nature and use of new instructional media, are utilizing these media to up-date subject matter. Guidance and financial assistance for the more ambitious studies are provided by foundations and other private sources, and, on an increasing scale, by the Federal Government. Some major curriculum studies for which new instructional materials are being prepared include the School Mathematics Study Group at Yale, the Biological Sciences Curriculum Study at the University of Boulder, the Modern Language Audio-visual Project at Wayne State University, and the National Science Foundation's project on the teaching of science.

Three special issues of *The Bulletin of the National Association of Secondary School Principals* (January issues in 1958, 1959, and 1960) describe a variety of instructional innovations under study in many secondary schools.

The NASSP's Commission on the Experimental Study of the Utilization of the Staff in the Secondary School, which is sponsoring the studies with financial aid from the Ford Foundation, is seeking ways of improving the quality of education through better utilization of the time and energies of the staff and students. In this connection, the Commission has encouraged experimentation with new instructional media.

The Ford Foundation, which is supporting various types of educational projects on a large scale, has proposed that the whole problem of classroom size, quality of instruction, and low teacher salaries is intimately related to the manner in which the talents of classroom teachers are employed. Decrying the "manpower waste" in education, the Foundation announced, in 1955, that it would embark upon experiments in the better utilization of teachers in order to afford them a better opportunity to be more effective and more professional.[4]

The Foundation proposes that education improve the use of its human resources to the same degree as agriculture, medicine, law, and engineering have done. The Foundation suggests that this goal may be achieved through use of teacher assistants and mechanical aids such as films and TV, which make possible an increase in pupil-teacher ratios.

Motion pictures . . .

Filmed courses in physics, chemistry, biology, and mathematics have been produced. The films may be used as supplementary material or, where a subject matter specialist is not available, as a source of basic information.

During the school year 1957–58, according to one authority, a physics film series consisting of 162 half-hour films was used in 400 American high schools—often in classrooms with no instructors.[5]

4. *Teachers for Tomorrow*, Bulletin No. 2, The Fund for the Advancement of Education, 1955, p. 40.
5. Maurice B. Mitchell, "Education—A New Era Begins," speech published by Encyclopedia Britannica Films, Chicago, May 1958.

Educational Services, Incorporated, formerly the Physical Science Study Committee organized at the Massachusetts Institute of Technology, is a broadly conceived education project which has developed a different approach to physics teaching through imaginative uses of instructional materials, including teaching films and laboratory apparatus.

In the school year 1958–59, 270 schools and 12,000 students were enrolled in the new course of study developed by the Committee with the help of physicists and high school teachers. The course had been developed out of concern for the quality of physics instruction available to the Nation's high school students. Members of the Committee had observed that greater changes had taken place in knowledge and understanding of physics in the past 50 years than in the previous 500, and had found that modern textbooks reflected almost none of this change.[6]

. . . and instructional TV

Nearly 600 school districts are currently making regular use of televised instruction, compared to about a half dozen, 6 years ago. The primary purpose of experimenting with this medium, according to the Ford Foundation, which is stimulating its use, is to multiply the effectiveness of able teachers.

There are no technical obstacles to a State, regional, or even a nationwide instructional television network.[7] Late in 1959, plans for a unique regional telecasting system were announced by the Midwest Council on Airborne Television Instruction. Courses on video tape originating from Purdue University are to be transmitted to a high-flying DC–7 and beamed to classrooms located in a circular area 400 miles in diameter.

The experiment, dubbed "Project Stratovision," to be launched next year, seeks to "help lift quality and efficiency of education in a six-state region involving 5 million students and 13,000 schools and colleges." Outstanding teachers will be recruited to serve the program, and "a staff of researchers and artists will be available to assemble or prepare special materials for individual faculty members" in order to make available to the smallest rural school "the finest curriculum and quality of instruction."[8]

The project, partly supported with a $6 million appropriation from the Ford Foundation, may be expanded to

6. E. P. Little, "A New Emphasis on the 'How' of Physics," *The Nation's Schools*, Vol. 65, No. 2 (February 1960), p. 104.
7. Four States, Alabama, Florida, North Carolina, and Oklahoma, have statewide educational television networks in operation. Georgia, Louisiana, Minnesota, New York, Ohio, Oregon, and Wisconsin have statewide ETV networks in varying stages of development. A regional ETV network is operating in the New England area and one is being planned to serve the South.
8. Midwest Council on Airborne Television Instruction, Memorial Center, Purdue University Campus, Lafayette, Ind., newspaper release, Oct. 16, 1959.

include an airborne TV system transmitting six simultaneous programs providing 72 separate half-hour units during a 6-hour school day.

The establishment of the multimillion dollar Learning Resources Institute is believed by some to be the harbinger of full-blown instructional technology in the classroom.

The news release announcing the formation of the Institute described the massive undertaking as "a new marriage of the science of the learning process with the technology of modern communications." The LRI "will devote much of its effort to improved instructional uses for TV, films, radio, learning machines and innovations in the development and use of written materials of all types." Supported through foundations and private corporations, the LRI will establish headquarters at Princeton, N.J.[9]

The term "systems of learning media" appears several times in the LRI's announcement. For some years, educators have been intrigued with the instructional possibilities arising from the use of a wide variety of teaching tools conveniently available to the classroom teacher.

As yesterday's dream becomes today's reality, the school administrator must carefully evaluate the potential of the new media in terms of his school program. In the light of continuing developments in new educational media, including tutorial devices, which I will discuss in the following section, administrators must anticipate new challenges in such areas as local control of curriculum, finance, classroom design, school organization, and professional tasks.

Self-Instruction Through New Media

The new technology has made possible not only mass instruction through films and TV but also self-instruction through various devices and processes.

This development is illustrated by the language laboratory and by "programed learning" through teaching machines and other automated devices.

Language laboratories . . .

The number of language laboratories which provide students with an individualized program of foreign language instruction through electronic aids has mushroomed in the past 2 years. The most recent estimate of the number of these laboratories in the Nation's high schools is 458, a sharp increase over the 64 reported in 1958. The current estimate is conservative, for it does not include schools with a minimum of equipment, such as a tape recorder with several jacks for listening.

Electronic devices are being employed to facilitate conversation in the modern foreign language under study. The "audiolingual" method helps high school students acquire a "near native" pronunciation of a foreign language by giving them opportunities for alert listening to and careful repeating after perfect native models. Meaningful drill, immediate correction of errors, criticism of one's own pronunciation, and progression at one's own rate of learning are essential elements of the process.

> **It is the job of the administrator to adopt the school to the new technology . . . If he cannot move forward, the individual teacher can do little.—*Mass Communication and Education*, Educational Policies Commission.**

In its complete form the language lab is an electronic installation consisting of a booth, headset, microphone, recording facilities for each student, and a monitoring setup for the teacher. Visual facilities may include a projection screen, a motion picture machine, and slide-, filmstrip-, and overhead-projectors.

Currently, foreign language specialists are recommending that high schools use modest equipment during the initial stage of teaching a language, including devices enabling students to listen to recorded language by native speakers and to repeat sounds and hear their own pronunciations, through simultaneous hearback. In addition, specialists say it is desirable to have tape recorders so that students can make occasional recordings.

The administrative problems associated with language lab instruction are many. They include the scheduling of classes, maintenance of equipment, inservice training of teachers, and evaluation of the program.

. . . and teaching machines

Programed material presented through teaching machines and other automated devices represents a dramatic instructional innovation. These tutorial devices range from simple pocket-sized punchboard cards to automatic, pushbutton, electromechanical machines capable of "teaching" a wide range of topics. They range in cost from less than $100 to thousands of dollars.

The teaching machine consists of the device, or "hardware," and the "program," or the teaching material printed on paper or some other medium such as film. The critical part of machine teaching is building good programs, a task requiring a skillful programer who has intimate knowledge of the subject matter—and a great deal of time.

Although teaching machines have aroused the imagination of psychologists, educators, and others, their practical application in the instructional process is in a state of infancy. Teaching machines are the subject of many different research studies conducted at institutions of higher learning and by commercial firms. Current activity takes the form of constructing devices, writing short programs, and testing their usefulness in classroom situations. The preliminary character of the teaching machine movement is shown by the fact that the latest issue of the *Review of Educational Research* dealing with instructional materials (April 1956) fails to make a single reference to these devices.

9. Learning Resources Institute, New York City, N.Y., newspaper release, Dec. 21, 1959.

According to the authors of an annotated bibliography containing over 100 studies and articles on the subject, teaching machine research is entering its "golden age." In 1957, only 8 teaching machine studies were reported; the figure increased to 35 the following year; and in 1959 the number of studies continued to multiply at a spectacular rate.[10]

At least 20 different types of teaching instruments have been devised as the result of recent experimentation. Several commercial agencies now have devices available for purchase by schools. This fall one firm will have available in quantity a simple recall, or write-in, machine which will permit teachers to program their own materials on standard size paper.

Teaching machines are by no means uniform in design or in programed material. Partial programs for machine teaching have been developed for a number of grade levels in many subjects, including spelling, arithmetic, algebra, grammar, psychology, foreign languages, and electronics.

A simple type of teaching machine contains programed material consisting of a series of fill-in type questions. One question at a time is exposed through a window. The student writes the answer on paper in a separate window. After he has written his answer, he operates the lever to move the question and his answer under a transparent strip of glass across the upper part of the window where he can still read them but cannot change his answer. Simultaneously, the correct answer is exposed. The student compares his answer with the correct one and presses a lever which scores incorrect responses. He then goes on to the next question.

Whether mechanical, electromechanical, or paper devices are employed, automated, or "automatic," teaching conforms to some basic principles. Corrigan enumerates them as follows:

> **(1) the individual is required to be continuously active in the learning process, (2) the individual progresses step by step in the learning task, proceeding only at a rate consistent with his demonstrated understanding, (3) the individual cannot proceed to more difficult material or different subjects until he has completely mastered all sequential steps required for complete comprehension and application, and (4) at every step in the learning process he is given immediate knowledge of results informing him whether he is correct or incorrect—and the reasons why.[11]**

Opinions differ on the potentialities of teaching machines, as they do on most innovations in educational methodology, but the Office of Education takes no position on these devices, either for or against. Since my purpose here, however, is to review technological developments, let me present some of the claims made for the machines by a number of their leading proponents.

B. F. Skinner, whose work has received a great deal of attention, has devised machines characterized by self-pacing and immediate reinforcement of responses. In an article published in 1954, he first described the nature of machine instruction and the theory underlying "programed learning".[12]

On the basis of knowledge gained from laboratory experiments on control of the learning process, Skinner proposes a sweeping revision of educational practices. He believes that his machines, which present material in such small steps that correct responding is virtually assured, can provide a new and better source of motivation than the "aversive methods" currently employed to stimulate learning. He says that through use of machines, growing school enrollments can be managed, dull students can learn the material presented by the machines as effectively as bright ones (though it will take them longer), and the consequent increase in educational productivity will lead to higher teacher salaries.

Skinner emphasizes that the machines will not lead to technological unemployment. Indeed, he believes that use of these mechanical aids will increase the importance of the classroom teacher. Machines can "reinforce" correct responses of students, a teaching task which they can perform better than a human instructor. The teacher's role would be enhanced, says Skinner, since her intellectual, cultural, and emotional contacts with students would be allowed to operate on a broader scale than is now possible.

S. L. Pressey, acknowledged as the pioneer in teaching machine research, has devised programed material along different lines from Skinner.[13] Pressey prefers multiple-choice questions to Skinner's construction-of-response devices. He permits some error in response, builds separate programs for superior students and, unlike Skinner, who proposes that machines should *supplant* some aspects of regular teaching and texts, believes the machines should *supplement* other teaching methods.

R. E. Corrigan sees among the important values of teaching machines the possibility of controlling the quality of subject-matter content. He also observes that teaching machines may provide standardization levels of achievement for individual students, and that continuous testing of the student's progress eliminates the necessity for periodic examinations.

Douglas Porter, one of Skinner's students, has conducted experiments with "write-in" machines containing spelling programs. Prompts or hints built into the pro-

10. Edward B. Fry and others, "Teaching Machines: An Annotated Bibliography," *Audio-Visual Communication Review* (Supplement 1), Vol. 8, No. 2, 1950, pp. 5–7.

11. R. E. Corrigan, "An Advanced Technology for Industrial Training Applications," paper presented at meeting of The American Society of Training Directors, Olympic Hotel, Seattle, Wash., November 1959.

12. B. F. Skinner, "The Science of Learning and the Art of Teaching," *Harvard Educational Review*, Vol. 24, No. 2 (Spring 1954).

13. Pressey's article, "A Simple Apparatus Which Gives Tests and Scores—and Teaches," published in 1926 in *School and Society*, represents the first major published article on teaching machines.

gram are gradually "vanished", or removed, until, by the time a student has completed a lesson, he is "on his own" and must repeat a response without cue. Porter points out that this technique eliminates a good deal of the guessing and wrong responses which characterize rote, or "drill" material. Porter also calls attention to the intense concentration and enthusiasm of elementary school children during the process of learning through machine teaching.[14]

Nicholas Fattu believes that the greatest potential of machine teaching lies in educational research. He says that there is hardly any aspect of the instructional process that could not be illuminated by mechanical devices, and stresses their value in eliminating the "teacher variable" that comparative studies on teaching methods have shown to exist.[15]

Edward Fry points up the following uses of machine instruction: Improving the limited curriculum offerings of small schools; providing individual help to students in study or library periods, and at home; and upgrading curriculum standards.[16]

A radical departure from simple "linear"-type machines is represented by "branching"-type devices which continuously adjust the program on the basis of the student's responses. There is on the market an elaborate "feedback" control machine for industrial and military training purposes, which presents the student with verbal material and with still and motion pictures, examines him on each piece of information, lets him know how well he is doing, in case of error "tells" him why he is wrong, and keeps a detailed record of his progress. According to its designer, the machine can be adapted to classroom instruction as appropriate programs are devised.

Parallel to the trend in automated teaching machines is the development of special books or various print and paper devices. Although these materials are not products of technology, they satisfy the basic postulates of automated teaching as set forth by Corrigan, and their programed material is similar to that used in mechanical devices.

The "scrambled book" introduced by N. A. Crowder, for example, is a simplified version of the "branching" machine previously described. Crowder's "intrinsic programing" technique refers to the alternate programs built into the basic material which provides for different types of error responses by individual students.

The pages of the "scrambled book" are numbered in the usual way, but are not read in the conventional order. There is no "next page" in this type of book until the student chooses one by selecting an answer to multiple-choice questions.

On the first page of the book, the student finds information followed by a multiple-choice question based on that segment of material. Each answer to the question is preceded by a page number. The student selects what he believes is the right answer and turns to the indicated page number.

If the student has made the correct response, the page to which he turns will contain the next unit of information and the next question. If he has made an incorrect selection, the page to which he has turned will contain material designed to correct his error and will direct him to return to the original page and to try again.[17]

The automated teaching field is expanding so rapidly that published information lags far behind the work that has been accomplished or that is in progress. The absence of a central source of information increases the difficulty of gathering material on the topic.[18]

Professional meetings of national associations which devote part or all of their program time to exploring issues in automated teaching represent an important source of information on developments taking place in this swiftly expanding movement.

Summary

The current educational scene is characterized by rising school enrollments, expanding bodies of knowledge, and higher educational requirements in the face of an inadequate supply of teachers, classrooms, and school funds. In light of these conditions, the school administrator's chief responsibility—improvement of the instructional process—becomes increasingly challenging.

The technological revolution influencing teaching practices and learning techniques is expanding in two directions: (1) Mass instruction, utilizing the motion picture and instructional television; and (2) individualized instructional processes, such as language laboratories, teaching machines, and other automated devices.

Many believe that these new media of communication are a potentially powerful educational force, that utilization of instructional technology in the classroom is overdue, and that education can be made more efficient and effective if the new tools of learning are widely and wisely used.

It is evident that effective classroom use of these rapidly expanding instructional tools will largely depend upon the quality of leadership exercised by school administrators.

EDITOR'S NOTE. In a second article, in May, Dr. Fusco will explore some of the problems the school administrator faces as technology creates new tools.

14. Douglas Porter, "Teaching Machines," *Harvard Graduate School of Education Bulletin*, Vol. 3, No. 2 (March 1958).
15. Nicholas Fattu, "Training Devices," *Encyclopedia of Educational Research*, 3d edition, Macmillan, 1960.
16. Edward B. Fry, "Teaching Machines: The Coming Automation," *Phi Delta Kappan*, Vol. 41, No. 1 (October 1959).
17. Norman A. Crowder, "Automatic Tutoring by Means of Intrinsic Programming" in Eugene Galanter (ed.), *Automatic Teaching: The State of the Art*, John Wiley & Sons, 1959.
18. A collection of major papers on teaching machines and programed learning will be published this summer by the National Education Association.

Reading *Aloud* and *Storytelling*

By Mary Helen Mahar, *Specialist for School and Children's Libraries*

When they got home, the Rat made a bright fire in the parlour, and planted the Mole in an arm-chair in front of it, having fetched down a dressing-gown and slippers for him, and told him river stories till suppertime. Very thrilling stories they were, too, to an earth-dwelling animal like Mole. Stories about weirs, and sudden floods, and leaping pike, and steamers that flung hard bottles—at least bottles were certainly flung, and from steamers, so presumably by them; and about herons, and how particular they were whom they spoke to; and about adventures down drains, and night-fishings with Otter, or excursions far afield with Badger. Supper was a most cheerful meal; but very shortly afterwards a terribly sleepy Mole had to be escorted upstairs by his considerate host, to the best bedroom, where he soon laid his head on his pillow in great peace and contentment, knowing that his new-found friend the River was lapping the sill of his window.

So Kenneth Grahame, in *The Wind in the Willows*, describes the age-old charm of storytelling—a happy pastime that parents and children can enjoy together. Whether a story is read aloud or told by a father to his little daughter at bedtime, by an accomplished storytelling librarian to a group of children in a city park or a public reading room, or by some other person to children on television, no special stage properties are needed—only the storyteller, the audience, and, of course, the story.

Eva Le Gallienne reads from *The Ugly Duckling*

Westinghouse Broadcasting Company in cooperation with the American Library Association has recently created new interest in reading aloud and storytelling with its television series, "Reading Out Loud," which should certainly do much to restore a practice reputed to be dying in many American homes. In this series prominent authors, political leaders, and stars of theatre, motion pictures, and sports, are reading aloud from their favorite books for children. Archibald MacLeish, for example, reads the poems of Walter de la Mare; Harry Belafonte, a Jamaican folk tale; Jose Ferrer, parts of *Huckleberry Finn;* Cyril Ritchard, *Alice in Wonderland;* Jackie Robinson, some highlights from Stephen Crane's *Red Badge of Courage;* and Richard Boone, Bret Harte's *How Santa Claus Came to Simpson's Bar.*

After the series has been presented over WBC–TV stations in Washington, Pittsburgh, San Francisco, Baltimore, Boston, and Cleveland, it will be syndicated nationally for noncommercial use and made available to all educational television stations. Kinescopes will be obtainable by purchase or rental. Under the chairmanship of Mrs. Augusta Baker, supervisor of storytelling, New York Public Library, a committee of the American Library Association has developed a list of books for reading aloud, entitled, *For Reading Out Loud to Your Family*, which will be useful not only during the series but for a long time afterward.

Parents, teachers, and librarians who wish to do more reading aloud and more storytelling may find Margaret Martignoni's "Family Reading and Storytelling," a helpful and attractive introduction to the subject.

It answers such questions as Why read together? What do you need to start a reading group? and, Who does the reading? (Sometimes the children do.) It also describes good stories to read aloud or to tell to different age groups and includes a bibliography.

In addition to its appeal to younger children in the home, school, library, storytelling has value as a club activity for older boys and girls, as a unit in speech classes, and as an adult education project. Those who wish to be introduced to the subtleties of the art of storytelling should read *The Art of the Story-teller* by Marie Shedlock and *The Way of The Storyteller* by Ruth Sawyer. The American Library Association has available five Thorne-Thomsen records. On these records Gudrun Thorne-Thomsen, a distinguished Norwegian storyteller, tells, with great artistry, Baldur, Gudbrand-on-the-hillside, Sleeping Beauty, and Tales from the Volsunga Saga.

Many public libraries have regular story hours, and storytelling is a usual procedure in elementary school libraries and classrooms. It is a good idea for beginners in reading aloud and storytelling to listen to experienced storytellers and to note techniques of voice, diction, and interpretation. However, every storyteller has a unique style and should develop his own talents.

Reading aloud also has special rules to be mastered; it is more difficult to hold the interest of children when a story is read than when it is told. Reading aloud is more successful when the reader is thoroughly familiar with the story and can look up often from the page and at his listeners. Moreover, some stories are more adaptable to reading aloud than others, and it is important to select from children's literature the stories most suitable for reading aloud.

It is better to tell folk tales than to read them. Folk tales—stories of enchanted people, talking beasts, giants, witches, and fairies—are wonderful to tell because they are vigorous, dramatic, and direct. As the storyteller becomes more familiar with folk literature, he often finds the plots of folk tales of Europe repeated in those of Asia—evidence of the universal values and appeal of folk tales. He will find, too, echoes of European tales in the tales of the United States.

Children and Books, by May Hill Arbuthnot, is a comprehensive introduction to children's literature—nursery rhymes, picture books, ballads, poetry, folk tales, animal stories, realistic stories, biography, and history. It contains an excellent chapter on storytelling and reading aloud and makes suggestions for appropriate books, stories, and poems.

Reading aloud and storytelling are not only friendly and entertaining activities but also significant creative experiences for both adults and children. It is important, therefore, that the literature used should be of high quality. Beginning storytellers should seek the advice of school and children's librarians and consult authoritative lists in selecting materials. Children are discriminating, and their happy responses to *good* reading aloud and storytelling are deeply satisfying and worth the trouble of careful preparation. Above all else, the teller should have enthusiasm for the story he tells and affection for his listeners.

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Pearl Buck tells a favorite Chinese fable

State Plans and Title III

By RALPH P. FRAZIER
Specialist, Science Equipment and Materials

WHEN school administrators meet, as they did recently at the convention of the American Association of School Administrators in Atlantic City, they compare notes and exchange ideas on many subjects. One of the subjects now foremost in their minds is title III of the National Defense Education Act. The exchange of information usually reveals differences as well as likenesses in the way in which title III programs are administered in various States.

To answer the question "Why are there variations among the State programs under title III?" it may be instructive to review briefly this legislation and the ways in which the requirements of the act may be met by the States.

Title III is categorical legislation; that is, it specifies the subject areas to be supported (science, mathematics, and modern foreign languages); the grade levels to be served (elementary and secondary); and the kinds of things for which funds may be expended (laboratory and other special equipment, including audiovisual materials and equipment and printed materials other than textbooks, and minor remodeling of laboratory or other space used for such materials or equipment). It also specifies that the States participating must provide supervisory and related services in science, mathematics, and modern foreign languages. These specifications are what provide the common elements in the program. And yet there are differences in the title III programs of the 54 participating States and Territories. How do differences arise and on what bases?

The variations become evident when the bases for participation are understood. Participation under title III is voluntary. If, however, a State or Territory chooses to accept the benefits of Federal aid, it must also accept the responsibility of compliance with the legislative provisions of the law. To comply, each State must prepare and execute a legal document known as a State plan.

A State plan embodies certain elements outlined under section 303 of the act. Although these provisions are familiar to most persons, it might be instructive to examine some of them in detail. First, however, a comment on State plans in general is apropos.

Although the law outlines the general provisions of a State plan, it makes the details of content a State matter. The subjects to be strengthened, the levels to be encouraged, and even the kinds of equipment and materials to be purchased are determined by the States within the limits of the law. As a result, there is variation among State programs. For example, some States have chosen to emphasize secondary school science in the first fiscal year and elementary science in the second; others do not give priority to any particular subject or any particular grade level but use other criteria, such as need, in establishing priority. A few States do not permit minor remodeling even though the law permits it.

To repeat: a State determines the program details of its plan so long as it complies with the general provisions of the act.

Priority Principles

One of the important requirements of the act is that the State plan include the principles for determining the priority of the projects submitted by the local agencies. The Congress, assuming that in some States local agencies would apply for more money under title III than was available—an assumption time has justified—decided that some method of selecting the projects to be supported was necessary. Each State agency therefore sets up a system of priority principles, which is also the device through which the agency can exercise its prerogative of deciding what subjects and what grade levels will be emphasized.

Among the States the principles of priority are many and varied. Some States, for example, give priority to projects that will assist schools deficient in equipment and materials in science, mathematics, or modern foreign languages in acquiring such equipment; some, to projects that will enrich existing programs in these subject areas; some, to projects for establishing pilot programs and demonstration centers as a means of improving instruction in these areas.

Many States felt that all projects should meet certain basic requirements before they could be considered for approval and therefore set forth specific eligibility requirements in their system of priority principles. Some States, for example, require the local agency to submit the plan on which it bases its project application, that is, its plan for improving instruction in one or more of the three project areas; some require it to submit evidence that its staff members are adequately prepared to utilize the equipment and materials requested.

Whatever its system of priority, however, and whatever its requirements for eligibility, each State emphasizes the projects it considers important in meeting its educational needs.

Equipment Standards

A second specific requirement of the law is that each State establish State standards for the equipment the local agencies will purchase under this title; and that it must include the

standards in its plan, along with a description of the methods and criteria the State educational agency used in establishing them. If a State was not ready to file its equipment standards when it submitted its plan, it was permitted to describe the methods and bases it would use in establishing the standards, but it could not legally approve any local projects until it had filed the equipment standards.

The States were encouraged to make use of publications from professional, educational, and technical associations in formulating their standard lists of equipment. Some States utilized the services of advisory committees, who drew upon a variety of sources for their material. Possibly the most influential source of information was the *Purchase Guide* of the Council of Chief State School Officers.[1] But whatever the sources and methods used in deciding on standards for equipment, the standards represent the judgment of the State educational agencies, not of the Office of Education. The inclusion or omission of an item of equipment from a State's standard list is a responsibility of the State. The equipment standards are considered to be open ended, and it is the prerogative of the State to modify them as experience dictates. The Office of Education has not published or suggested standards for equipment.

Project Applications

To aid the local educational agency in applying for a project, the State educational agency indicates in its plan the information to be contained in an application, the form and contents of the application, the time of submittal, and the criteria to be used for approval.

The information a local agency supplies in an application varies considerably from State to State. For example, one State asks for only 6 items of information, and another State asks for 21 items. What and how much information a State requests depends, in part, on its principles of priority and standards for equipment. The State agency must have enough information to enable it to make a rational judgment about the worth of a project to the whole educational program of the local educational agency.

STATE PLANS

SEC. 303.

(a) Any State which desires to receive payments under this title shall submit to the Commissioner, through its State educational agency, a State plan which meets the requirements of section 1004(a) and—

(1) sets forth a program under which funds paid to the State from its allotment under section 302(a) will be expended solely for projects approved by the State educational agency for (A) acquisition of laboratory and other special equipment, including audio-visual materials and equipment and printed materials (other than textbooks), suitable for use in providing education in science, mathematics, or modern foreign language, in public elementary or secondary schools, or both, and (B) minor remodeling of laboratory or other space used for such materials or equipment;

(2) sets forth principles for determining the priority of such projects in the State for assistance under this title and provides for undertaking such projects, insofar as financial resources available therefor make possible, in the order determined by the application of such principles;

(3) provides an opportunity for a hearing before the State educational agency to any applicant for a project under this title;

(4) provides for the establishment of standards on a State level for laboratory and other special equipment acquired with assistance furnished under this title;

(5) sets forth a program under which funds paid to the State from its allotment under section 302(b) will be expended solely for (A) expansion or improvement of supervisory or related services in public elementary and secondary schools in the fields of science, mathematics, and modern foreign languages, and (B) administration of the State plan.

(b) The Commissioner shall approve any State plan and any modification thereof which complies with the provisions of subsection (a).

In some States employees of the State agency—supervisors or consultants in science, mathematics, and modern foreign languages or the coordinator of title III programs—process the project applications and determine their priority. If the title III coordinator is charged with the responsibility of making the final decisions, he usually seeks the advice and counsel of the subject-matter supervisors. In a few States advisory committees make decisions on the acceptability or nonacceptability of projects.

Supervisory Services

State plans contain many other important elements in addition to priority principles, equipment standards, and project application forms. One of them, financial aid to strengthen supervisory services, is particularly important.

In drafting title III the Congress recognized that simply furnishing laboratory equipment and materials to the schools was inadequate to improve instruction in science, mathematics, and modern foreign languages; that some form of supervisory activity was needed to insure the most advantageous use of the equipment and materials acquired under the program. Toward this end, the Congress provided for aid to the States in improving their supervisory and related services.

Almost all States and Territories had some form of supervisory and related services prior to the passage of the National Defense Education Act. However, the number of supervisors who were specialists in science, mathematics, or modern foreign languages was relatively small. Now with title III aid, the States have an opportunity to add well-trained persons to their staffs. How well the States have grasped this opportunity is indicated by the fact that State

[1] Council of Chief State School Officers, *Purchase Guide for Programs in Science, Mathematics and Modern Foreign Languages*, Ginn & Co., 1959, 336 p.

agencies now employ 160 supervisors, full time or part time, in science, mathematics, and modern foreign languages, in contrast to 33 before the act. [More detail on supervisors is given in the following article.]

The duties of the subject-matter specialists are included as a part of the State plans. Although there are differing viewpoints among the States on the exact role of the supervisors, there are many areas of agreement. Among the duties the States mention are the following: Organizing and conducting inservice programs, providing consultive services to local educational agencies, preparing and disseminating publications, evaluating educational programs of local school agencies, and assisting local agencies in preparing project applications.

The State supervisory program can provide much of the leadership and knowledge needed to bring science, mathematics, and modern foreign language teaching up to the requisite level. The burden is a heavy one. But it is a burden that is shared by teachers, local administrators, and State staff members.

AN EVALUATION of the accomplishments of title III must wait until some future date. We know now, however, that the educational accomplishments will depend on the statesmanship of the persons responsible for carrying out the provisions of the title.

State Supervisors

In Science, Mathematics, and Modern Foreign Languages

By KENNETH E. MOWREY
Assistant Specialist, Secondary School Science

THE recent great increase in the number of science, mathematics, and modern foreign language supervisors and consultants employed by State or Territorial education agencies is a significant development in education. (States differ in the titles they give to these specialists, but I am making no distinction between State department employees who are designated either as supervisors or as consultants.) Many factors have contributed to this growth, but the National Defense Education Act has certainly been a major stimulating force, and it has aided materially in helping provide the services because of the financial support it makes available.

In the 18 months since the act was passed, the number of supervisors employed by State departments has been increased by 127, from 33 as of September 2, 1958, to 160 as of March 1, 1960.

Field	*Sept. 2, 1958*	*Mar. 1, 1960*
Science	11	59
Mathematics	9	39
Modern foreign languages	8	41
Science and mathematics combination	5	20
Science and modern language combination	0	1
Total	33	160

These totals become more significant when it is noted that several States have supervisors with titles such as consultant in secondary education; supervisor of elementary ed-

State supervisors for science (S), mathematics (M), and modern foreign languages (L), March 1, 1960

STATE	S	M	L	S & M	Total
Alabama	3	2	1	1	7
Alaska	....	....	....	....	....
Arizona	....	....	....	....	....
Arkansas	1	1	1	....	3
California	....	....	1	....	1
Colorado	1	....	1	2	4
Connecticut	1	1	....	....	2
Delaware	....	....	....	....	....
District of Columbia	2	2	2	....	6
Florida	2	....	1	....	3
Georgia	6	1	1	....	8
Guam	....	....	....	....	....
Hawaii	1	1	1	....	3
Idaho	....	....	1	1	2
Illinois	6	....	2	....	8
Indiana	1	1	1	....	3
Iowa	2	1	....	....	3
Kansas	....	....	1	1	2
Kentucky	1	....	....	....	1
Louisiana [1]	2	3	1	1	8
Maine	2	1	1	....	4
Maryland	....	....	1	1	2
Massachusetts	2	1	1	1	5
Michigan	....	....	....	....	....
Minnesota	1	2	....	....	3
Mississippi	1	1	1	2	5
Missouri	1	....	1	4	6
Montana	....	....	1	1	2
Nebraska	....	....	....	....	....
Nevada	....	1	....	....	1
New Hampshire	....	....	1	....	1
New Jersey	....	....	....	2	2
New Mexico	1	1	1	....	3
New York	5	4	4	....	13
North Carolina	1	1	....	....	2
North Dakota	....	....	....	1	1
Ohio	1	1	1	....	3
Oklahoma	....	....	1	....	1
Oregon	1	1	1	....	3
Pennsylvania	3	2	2	....	7
Puerto Rico	4	4	....	....	8
Rhode Island	....	....	....	....	....
South Carolina	1	....	....	....	1
South Dakota	....	....	....	....	....
Tennessee	1	1	1	....	3
Texas	1	1	2	....	4
Utah	1	1	1	....	3
Vermont	....	....	1	1	2
Virginia	1	1	1	1	4
Virgin Islands	....	....	....	....	....
Washington	....	....	....	....	....
West Virginia	1	1	1	....	3
Wisconsin	1	1	1	....	3
Wyoming	....	....	1	....	1
Total [1]	59	39	41	20	160

[1] One supervisor of science and modern foreign language combined is included in the Louisiana total.

ucation; chief, bureau of secondary education; director, elementary education; and consultant of audiovisual education. Some of these persons are assigned supervisory responsibilities that include science, mathematics, and modern foreign language. Such employees are not included in the tables.

The table lists the 54 States and Territories[1] participating under the title III programs and the number of persons employed in the various subject areas in each State.

A summary of the table shows that as of March 1, 1960, States have supervisors as follows:

32 have science supervisors.

27 have mathematics supervisors.

34 have modern foreign language supervisors.

14 have science and mathematics supervisors.

1 has an elementary science and modern foreign language supervisor.

44 have a supervisor in at least one of the three subject areas.

28 have supervisors working in all three subject areas.

39 have at least one supervisor assigned some special responsibility for science.

36 have at least one supervisor assigned some special responsibility for mathematics.

34 have at least one supervisor assigned some special responsibility for modern foreign languages.

Reports by States and recent correspondence with State administrators indicate that the number of State supervisors in science, mathematics, and modern foreign languages will continue to increase. Many State administrators report that they plan to employ additional supervisory personnel as rapidly as possible to assist in the improvement of instruction in these subjects.

[1] As of March 1, 1960, the Panama Canal Zone was not participating in title III.

Statistic of the Month

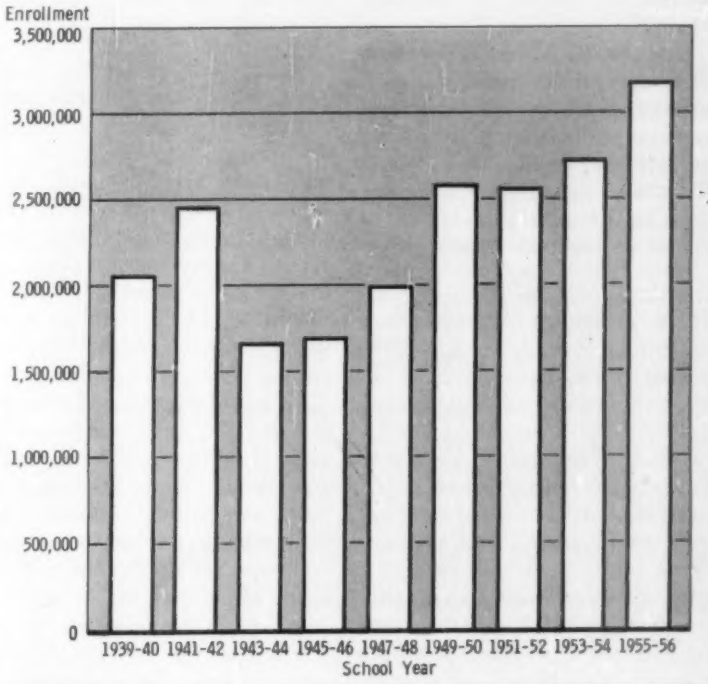
Adult Education in Public Schools

ENROLLMENT in adult education in the public elementary and secondary school system increased by slightly more than 1.1 million, or about 55 percent, between 1939–40 and 1955–56, from about 2.1 million to 3.2 million. The increase was interrupted during World War II and the years immediately following, when enrollments fell below 2 million.

The increase over the years reflects not only the increase in population but also the growing importance of adult education as a part of the total public school program. In 1939–40 the number of adults enrolled in educational programs (see definition below) equalled 8.1 percent of the total enrollment (25.4 million) in public elementary and secondary schools; in 1955–56 it equalled 10.2 percent of the much larger total enrollment (31.2 million).

The Common Core of State Educational Information (Office of Education Bul. 1953, No. 8) defines public adult education as including organized educational programs—other than regular full-time and summer elementary and secondary day school and college programs—that provide opportunity for adults and young people out of school to develop skills, knowledge, habits, or attitudes through formal instruction or informal group leadership directed toward recognizable learning goals. The definition excludes activities that are primarily social, recreational, or productive of goods.

For further information, including information on instructional staff and expenditures, by States, see Adult Education in Public Schools, 1940–56, Circular 602 (OE–13000), available from the Government Printing Office for 20 cents.—Emery M. Foster, Chief, Research Studies and Surveys Section.



ad Minutes

Briefly noted --- for the busy School Administrator

Material for this department is prepared in the School Administration Branch, Division of State and Local School Systems, by H. D. Evans, Jr. Contributors are the specialists in the Branch—this month, Don M. Dafoe, Elmer C. Deering, Charles O. Fitzwater, Gene C. Fusco, Peter P. McGraw, Ivan N. Seibert, and Alpheus L. White.

Machine Processing. A recent week-long conference in Endicott, New York—the first of its kind for State education agency representatives—reflects the growing desire of schoolmen to learn how machines may be used to do much of the educational record keeping and many of the statistical operations now done by hand. At the meeting, sponsored by the International Business Machines Corporation, 53 representatives from State educational agencies, through lectures, demonstrations, and seminars, learned what data-processing machines can do and how to apply machine processing methods to education statistics.

Town Meetings. The Superintendent of Schools in Abington, Pennsylvania, has developed an effective method of determining the attitudes of local citizens toward school problems. Each year the superintendent invites 1,000 representative citizens of the community to list, on a form he sends them, topics to be discussed at a monthly town meeting on the education program. Using the forms returned as a guide, he sets up a schedule of meetings and disseminates copies of it widely in the community.

School board members, representatives of organized community groups and the press, interested citizens, and school staff members are invited to these meetings. The meetings, held in the evening and featuring question and answer periods and discussion groups, have been well attended.

Speeding Up the School Census. Although they recognize that wise administrative planning calls for up-to-date reliable data, many local administrators have long thought of the annual school census as a cumbersome chore. To make it easier, the Utah State Department of Education has undertaken a pilot problem using machines. Local enumerators in two pilot school districts take the census and put the information for each child on individual mark-sense cards. These are sent to the State educational agency where the data are punched on cards for machine processing. After machine tabulation, the information is reported to the school district.

Through this method the State gets the information required by statute much more quickly than formerly, and the effort and expense of intermediate tabulations are eliminated. In addition to preparing data with speed, economy, and accuracy, the new system will create a set of census cards ideally suited to conversion into a master student file, which can be used in preparing attendance records, schedules, and report cards.

Safe Bus Drivers. The 410,000 Georgia children who go to school in buses will ride more safely from now on. A Mobile Driver Testing Laboratory, sponsored and operated by the Georgia Motor Trucking Association, Inc., in cooperation with the State Department of Education and the Department of Public Safety, is now giving the State's 4,800 school bus drivers exhaustive tests to determine their mental and physical capabilities. Using modern equipment, including some of the type used by the Air Force in testing prospective pilots, the laboratory tests the drivers for general vision, color perception, reaction time, side and night vision, distance judgment, glare resistance, steadiness, and driving knowledge. The State Board of Education has ruled that all school bus drivers or prospective drivers must pass the test.

Better Boardmanship. How can the inexperienced new school board member learn his business? How can he benefit from the knowledge and experience of seasoned board members and educators? Here are some examples of the guidance methods now being used in different States.

The Alabama Association of School Boards has published *Handbook for Alabama School*

Boards, in which the authors, George Howard and J. E. Thomason, point up accepted practices and procedures that lead to effective school board performance.

The Ohio School Boards Association conducts schools for new board members in its five regional divisions. The 1- or 2-day courses consist of lectures, seminars, and panel discussions on subjects ranging from community relations to school finance.

In Orleans Parish, New Orleans, La., the local board distributes two manuals. One presents the board's rules and regulations; the other, its policies on organization and procedures, educational programs, and community relations.

More Language Instruction. For the first time the number of high school language laboratories exceeds the number of college language laboratories. The Office of Education estimates the number of language laboratories in the Nation's high schools at 458. Before NDEA there were only 64. The number in colleges is now estimated at 452. Before NDEA there were 240. Another indication of progress in language instruction: There were but 16 high schools in the Nation offering Russian in the pre-Sputnik era; now there are 450.

Citizens Help Organize. Despite a redistricting law that is not one of the strongest in the Nation and a State finance plan that offers little inducement for establishing larger districts, Iowa in recent years has led the Nation in reducing the number of school districts.

This striking improvement is partly the work of citizens committees which throughout the State are helping to do the planning required for improving local school structure. The State Department of Public Instruction, realizing the value of local leadership in solving redistricting problems, has encouraged the movement with advice and publicity.

The citizens committees, which range from 30 to 60 members or more, are formed in several ways: In some communities they are appointed by the school board; in some they are the result of efforts by parent-teacher and other civic groups; in some the impetus has come from school administrators and teachers.

The committees have become part of a team, working together with reorganization specialists from the State Department of Public Instruction, county superintendents and their boards, and local school administrators to achieve sound basic units for their schools.

Open Board Meetings. More and more local school boards are opening their meetings to the public. In some States the local board is free to decide whether its meeting shall be open or closed, but Colorado, Washington, Pennsylvania, and California are among the several States with laws requiring that school board meetings be open, except for necessary closed executive sessions when topics such as negotiations toward purchase of a school site are to be discussed. However, these laws specify that action may be taken only in an open session.

Why They Vote No. With public interest in education at such a high pitch, why in some sections are there repeated casualties among school financial referendums? There are few postmortems, and reasons for defeat usually remain obscure. →

BOND SALES: Each month this column will report on bond sales in the United States for the public schools. Despite some lag in the reporting by investment bankers to our source of information, the Investment Bankers' Association of America, enough information on the volume and distribution of bond sales is available by the end of each month to reveal current trends.

Bond sales in the United States for public schools, quarter ending Dec. 31, 1959

Issuing agency	Number of sales reported	Total amount sold (thousands of dollars)	Net interest rate [1]		
			Low (percent)	Average (percent)	High (percent)
State	3	30,500	3.24	3.31	3.60
County	14	8,518	3.27	3.74	4.87
School district	457	336,101	3.03	3.96	6.32
City, town, township, village, etc.	52	66,315	3.06	3.72	4.75
Authority, holding company	24	27,586	3.38	4.07	4.84
All	550	469,020	3.03	3.89	6.32

[1] Net interest rates on school bonds reached their highest point in 1958–59 in September 1959, with 4.09 percent. In December 1959 the rate was 3.98.

Not content to wonder why New York voters reject referendums, the New York State Department of Education keeps in close touch with reactions of the local electorates through periodic surveys. The department's research office sends questionnaires to all city, village, and district superintendents requesting information on bond proposals voted on during the year.

Department studies based on these surveys suggest that certain conditions influence voters to accept or reject school-expenditure proposals. The studies may be of interest to boards of education and school administrators in other States.

In one of the recent studies, Theodore Bienenstok and William C. Sayres focus attention on the voter opposition in "high resistance" districts with records of multiple rejections. They found that voter concern with high costs is most often cited by superintendents as the reason for defeat of referendum proposals. Their findings also indicate that there is little evidence of "taxpayer apathy or complacency"; that campaign interest is usually high; and that "taxpayers are deeply concerned with a situation where heavy enrollments and limited taxable resources make it seemingly impossible to boost relatively low expenditures without raising already high taxes continually higher."

This study notes certain other recurrent themes in the rejection of financial referendums:

- If the voter is not informed of the real educational need for certain additional or improved facilities, he will reject some proposals, labeling them "frills."
- Proposals are sometimes caught in the crossfire developing from internal conflicts and disputes, and voter opposition is often traced to local issues and altercations not directly concerned with a specific referendum.
- Organized opposition by economy-minded homeowners and taxpayer groups frequently challenges all educational spending which may result in a substantially increased tax-load.
- Linked closely to the other reasons for rejection of school expenditure proposals is the frequent lack of adequate and effective communication between the school authorities and the voters.

Some Rural School Facts

By Walter H. Gaumnitz
Chief, Research and Statistics, Local School Systems

In the United States rural education is at present widely regarded as a passing show. Many of us are so much impressed with the growth of our large cities, the outreach of our sprawling suburbs, and the pervasiveness of crowded parkways connecting city with city that we lose sight of the fact that we still have a good many rural schools. Rural life, agriculture, rural school districts, and small schools have recently been decreasing so rapidly that their passing is likely to be accepted as accomplished.

To clarify our minds on these matters, let us examine some of the facts. A recent survey of education in rural counties reveals that in 1955–56 of the 3,068 counties in the U.S. 1,706, or 57.4 percent, were rural; that is, 60 percent or more of the inhabitants in these counties lived in rural areas outside of villages and towns of 2,500 or more.[1] The counties identified as rural contained 49.1 percent of all districts operating public schools, 40 percent of all school plants, and 18 percent of the total population.[2]

In 1955–56 public schools in these rural counties served 6.2 million children, or 20 percent of the total U.S. public school enrollment; employed an instructional staff of 249,611 persons, or 22 percent of the total public school staff; and spent $1.4 billion to maintain schools, or 17.1 percent of the total current expenditures for public schools that year. These figures surely point to one conclusion: Rural education has not yet disappeared.

Rural schools are often casually referred to as small, implying that they are also simple, easy to operate, and of little consequence. It is true that many rural schools are small (we still have 25,000 one-teacher schools[3]) but judging by the total number of boys and girls who must depend on them for their education, they are not inconsequential and they have a big job to do. Furthermore, the very smallness of some schools creates a great number of problems. For example, anyone who has ever

[1] Biennial Survey of Education in the United States, *Statistics of Local School Systems: 1955–56, Rural Counties*, Chapter 3, Sec. IV. Office of Education, 1959.

[2] *Statistics of Rural Schools—A U.S. Summary, 1955–56*, Circular No. 565, U.S. Office of Education, 1959.

[3] *Small Schools Are Growing Larger—A Statistical Appraisal*, Circular No. 601, U.S. Office of Education, 1959.

tried at one and the same time to provide maximum educational opportunities to all the children in a one-teacher school—they usually range from 6 to 16 years old—knows that such a teaching assignment is one of the most difficult to be found anywhere.

To take another example, let us look at the small high school. Nearly two-thirds of all public high schools in the country are located in centers of less than 2,500 population. Most of them are small; in 1955–56 they had an average enrollment of 177 pupils per school and an average instructional staff of fewer than 9 teachers. Obviously such a small staff would find it most difficult to provide adequate instruction to the growing numbers of boys and girls who now wish to prepare for college. This is not, however, their only task. They must also provide for the boys and girls who are not going on to college: the boys who want to lay a foundation in scientific farming, the boys and girls who want to enter one of the many industries, trades, or social science fields.

With modern mechanization more and more rural children obviously must seek their future away from the farm—in offices, factories, and hospitals. They must be prepared to compete favorably with city boys and girls.

The small rural schools must also wrestle with problems resulting from low pupil-teacher ratios and their influence on per pupil costs. The rural county survey found an average of 29 pupils per teacher in elementary schools and 20 per teacher in secondary schools. For cities comparable data showed a ratio of 31 to 1 in elementary schools and 24 to 1 in secondary. The rural schools in the more sparsely settled areas of the North Central and Western States average 24 pupils per teacher in elementary and 17 in high schools.

Some comparisons [4] between rural and city school finances shed further light on the problems peculiar to rural education.

Item	*Rural*	*City*
Average salary of instructional staff	$3,123	$4,707
Average per pupil expenditure (A.D.A.) for instruction	152	220
Total current expenditure per pupil	221	304
Per pupil expenditure for transportation	21	5

Thus salaries in rural schools averaged only two-thirds those in the city schools and rural current expenditures averaged less than three-fourths those of the cities.

These financial differences have many implications of educational significance. The cost of living is no doubt lower in the country, but life is also less comfortable and to many less attractive. As a result, many of the best teachers prefer to teach in the city. The pupil-teacher ratio is lower in the country, and obviously more of the available funds go into pupil transportation. We might expect these two factors to produce higher current per pupil expenditures, but they are apparently offset by the higher salary rates in the cities and by the costs of providing more and better teaching materials, better janitorial services, and the like.

The data I have reviewed show pointedly that there are still many rural schools, that their tasks are by no means small or lacking in complexity, and that their financial status adds to their problems. Considering the rural schools of the Nation as a whole, apparently we still expect them to do the hardest jobs with less. Rural education still looms large in numbers of schools, teachers, and pupils. Its problems still call for the best possible leadership.

CENSUS
(*Continued from p. 17*)

Implications for education

The cross-classification of educational characteristics with the many combinations of other social and economic characteristics makes census data particularly useful in educational planning and research. Not only are the data tabulated on a national and State level, they can also be obtained for counties, cities, and other local areas. Such data assist school administrators in operating school districts efficiently and in expanding their knowledge of the community.

The educational research specialist might use census data in many types of investigations. The following list is representative.

1. To project the school-age population and school enrollment for use in planning for school construction, staff, equipment, and facilities.

2. To evaluate enrollment rates by age, age-grade relationships, and average educational levels of the adult population.

3. To study age-grade distributions and other characteristics (both personal and family) of public versus private school students.

4. To estimate the number of functional illiterates, by area and population subgroup, for use in instituting adult education programs.

5. To study socioeconomic factors associated with high and low educational attainment of adults and with the extent of acceleration or retardation of children in school.

6. To classify school dropouts by personal characteristics and school-age persons not in school by personal and family characteristics.

7. To discover employment patterns by level of attendance. How many students work, in what occupations, and what do they earn?

8. To study migration of school children: How many move to new school district areas each year?

9. To determine the number of high school and college graduates in the population and in different subgroups of the population.

10. To measure the educational levels of persons in different occupational groups. To determine the characteristics of teachers, by level, and of professors and instructors.

11. To study the economic effects

[4] *Selected Indexes of Rural School Finance in the United States*, Circular No. 566, U.S. Office of Education, 1959.

of increasing amounts of education—relating the amount of education to such items as income, occupation, and employment status.

Taking the Census

The procedure for taking the 1960 census has a number of new facets which may be interesting to school administrators. The public will be expected to participate much more actively than heretofore. About one week before Census Day, the Post Office will deliver to each household an Advance Census Report containing a questionnaire. The members of the household will be asked to complete this report before April 1 for themselves.

The Census Bureau expects this procedure to produce accurate replies to its inquiries and to reduce the time the enumerator will spend in each household because he will be required only to transcribe the information. However, the Advance Census Report will contain only those questions which are to be asked of the total population. At every fourth household the enumerator will leave another questionnaire, which is to be filled out and mailed to the local Census office. The second, or "sample," questionnaire contains a major proportion of the census questions, including those on education.

This self-enumeration technique, being used for the first time extensively in a U.S. Census, has been employed for many decades in a number of European countries, for example, in Germany and France.

The primary aim of our census, as provided in the Constitution, is to insure that all of the people are counted since the count is used in determining the number of representatives to which each State is entitled in Congress. To this end, we have traditionally sent enumerators ranging far and wide to make sure that everyone was included. At each household, however, they were required painstakingly to inscribe detailed information for each member, usually obtaining the information for the household from the person at home at the time of their visit. This year enumerators will again be making their rounds, but this time each member of the household will have had an advance opportunity to report accurately for himself.

Processing the Results

The techniques to be used for processing the results of the 1960 Census have been streamlined and made as fully automatic as possible. Once the schedules have been completed by the enumerators and a few supplementary codes have been entered in the field offices, the mechanical operations will shift into high gear. First, a microfilm copy of each face of the form will be made in the field. The reels will then be shipped to Washington for the first step in the assembly-line process.

The Census Bureau has developed a machine with the intriguing name of FOSDIC (Film Optical Sensing Device for Input to Computer), which will read the information in the microfilm copies of the schedules by means of a photoelectric device and record this information in the form of magnetized dots on a metal tape. The schedule was designed to be used on this machine. The illustration of the schedule shows a part of the one-in-four sample section of the FOSDIC schedule.

The light circles scattered throughout are to be marked by the enumerators. The heavy black squares enable the photoelectric cells within the machine to position themselves. The cells then very rapidly scan an area between squares and whenever they sense a mark an impulse is transmitted to the magnetic tape. FOSDIC operates at the rate of about 150 microfilm frames per minute.

The printing of the schedules was in itself a major undertaking. Inasmuch as an impulse for the magnetic tape is triggered by the presence or absence of a mark on the schedule, a number of problems had to be overcome. For example, will a mark on one side of the schedule be sensed when the reverse side is being scanned? How light a mark can be tolerated? What are the effects of erasures? And what are the limits on the size of a mark?

Once the information has been recorded on magnetic tape, it is fed through the electronic computer. Four Univac 1105 computers will be available for this task, with data-processing speeds measured in thousandths of a second. Since the computer cannot think for itself, it must be told what it is to do by means of "program tapes," containing instructions. Very briefly, this is the procedure: the basic data tapes that come from the FOSDIC will be fed into the Univacs, which will "edit" the data for consistency and make the appropriate corrections; arrange the data into the required distributions; perform the computations such as percentage distributions, ratios, means, and medians; and then record the results on other magnetic tapes.

The next step is another new development in the rapid processing of large masses of data. As the tape comes from the Univac it is run through the High Speed Printer, which translates the magnetized dots into numbers and prints them mechanically in tabular form on sheets with preprinted headings and stubs at a speed of 600 *lines of data* per minute, or at a rate of about eight full tabular pages per minute.

These pages are ready to be photo-

> The products of the Bureau of the Census are like the oxygen in the air. They are consumed so widely that they are accepted as a matter of course and are so often used after analysis and interpretation by one or more intermediaries that the user does not readily recognize their source or their fundamental value as a base for most other statistics.
>
> —SAMUEL STOUFFER, *professor of sociology, Harvard University.*

graphed, reproduced by offset and bound into census bulletins.

Publications

Soon after the enumerators submit their completed work, the work of counting the population will begin. Preliminary counts for local areas will be made available in May and June. Adjustments will continue to be made until November, when official State totals must be reported to the President. State bulletins containing final totals for counties, cities, towns, villages, and rural areas will be issued before late spring of 1961. The State series containing general demographic, social, and economic data will be issued during 1961, and the series containing detailed cross-tabulations will be issued in late 1961 and early 1962. A series of special research reports, including one on education, will be published in 1962.

Planning for the Future

As soon as one census has been completed, planning begins on the next one through the evaluation of the results, study of the continued reactions of users of the data, and experimentation with new ideas and questions. The Bureau has been able to use its monthly national sample survey as a vehicle for experimentation. At least once each year it includes questions on education and occasionally checks the extent of illiteracy in the Nation.

At the request of the Office of Education, the Bureau included questions on adult education activity in the October 1957 survey. Both the Bureau and the Office hoped that the information gathered would aid them in preparing an adult education question for the 1960 Census. Although valuable data were collected, there was not enough time to develop an adequate question before final plans for the 1960 Census had been completed. The Office of Education plans to explore further the possibilities of experimentation with questions on adult education and other educational inquiries for the 1970 Census.

FROM THE PRESIDENT

(Continued from page 5)

The universality of the hope for peace and the imperative character of its need cannot fail, around the globe, to develop in our youth the qualities of the heart and mind that will surely, one day, be inscribed on the permanent pillars of peace in freedom.

In this hope, among the things we teach to the young are such truths as the transcendent value of the individual and the dignity of all people, the futility and stupidity of war, its destructiveness of life and its degredation of human values. This kind of understanding will help make of them not only useful members of societies, but will increase their effectiveness in pursuing the goal of world peace. Through patient education in our homes, churches, and schools, free and peaceful societies will be perfected and perpetuated. Problems and circumstances change, priceless human qualities and values must never be lost. * * *

Now there is a specific problem that could never be ignored in such a study as you are making.

Juvenile delinquency has increased each year for the past ten years, and has become not merely a local, but a world-wide, concern. The causes of this condition are multiple, and multiple measures must be used to weed them out.

Yet we must beware of a tendency to generalize pessimistically about our youth—to attribute to the many the failures of the few. Such terms as "lost," "misguided," or "off-beat," have had their counterparts in earlier generations.

I have an unshakable faith in the overwhelming majority of fine, earnest, high-spirited youngsters who comprise this rising generation. They possess a more intense intellectual curiosity than we of my age exercised when we were their age. They are wise for their years and they are fast learning the relationship between physical and mental fitness on the one hand, and satisfaction in accomplishment on the other. We strive to make certain that the number of failures is held to a minimum. And in this effort we have developed appropriate programs — physical, recreational, educational, moral, psychological, occupational. Underlying all these as both a preventive and a cure is a happy family; one that finds its greatest enjoyment as a group in such things as the family picnic, family games, the "cookout," or the home movies.

From the play pen to the campus our task is not to provide the conditions of an affluent existence for the young, but rather to teach them that such things have real value only as they are earned. We must see to it that our children grow up in a climate that encourages response to intellectual challenge, in self-reliance, initiative, and a healthy regard for hard work and the dignity of man. * * *

As the person responsible for calling you together, I felicitate our Nation on your readiness to undertake and persist in this noble task. I assure you of my deep appreciation of your effort. May every success attend you.

SCHOOL PLANNING

(Continued from p. 15)

ing the next few years will enable us to get better school plants for the money we invest. It is doubtful, however, that we can make any substantial savings in the cost of constructing a school building. Improvements will be made in teaching techniques and in instructional aids, but it is unlikely that we can reduce the cost of instruction. There is one thing we can do with better facilities and better techniques: We can improve the quality of education.

Charles F. Carroll, State Superintendent of Public Instruction in North Carolina, has very appropriately said: "The heaviest and most burdensome tax we can pay is the tax on ignorance." We cannot afford ignorance. We *can* afford education.

OFFICE OF EDUCATION PUBLICATIONS CHECKLIST

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(Order from Superintendent of Documents, U.S. Government Printing Office, Washington 25, D.C. Remittance must accompany order.)

ADMINISTRATION OF PUBLIC LAWS 874 AND 815, 9TH ANNUAL REPORT OF THE COMMISSIONER OF EDUCATION, JUNE 30, 1959. 1960. 166 pp. 60 cents. (OE–22003.)

ADULT EDUCATION IN PUBLIC SCHOOLS, 1940–56, DATA ON ENROLLMENT, INSTRUCTIONAL PERSONNEL, AND EXPENDITURES, by *Marthine V. Woodward.* 1960. 14 pp. 20 cents. (OE–13000.)

A STUDY OF CURRICULUM DEVELOPMENT IN THE HIGH SCHOOL COOPERATIVE PROGRAM. 1960. 22 pp. 15 cents. (OE–82000.)

HIGHER EDUCATION PLANNING AND MANAGEMENT DATA, 1959–60, SALARIES, TUITION AND FEES, ROOM AND BOARD, by *W. Robert Bokelman.* 1960. 104 pp. 70 cents. (OE–53004).

THE RETARDED CHILD GOES TO SCHOOL, by *Harold M. Williams.* 1960. 24 pp. 15 cents. (OE–35000.)

UNDERSTANDING TESTING, PURPOSES AND INTERPRETATIONS FOR PUPIL DEVELOPMENT, edited by *Kenneth F. McLaughlin.* 1960. 24 pp. 25 cents. (OE–25003.)

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DIRECTORY—TEACHER TRAINERS OF TRADE AND INDUSTRIAL EDUCATION. January 1960. 11 pp.

EDUCATION IN ITALY, by *George A. Male.* February 1960. 12 pp. (Information on Education Around the World No. 39–WE. OE–14027.)

EDUCATIONAL AM AND FM RADIO, AND EDUCATIONAL TELEVISION STATIONS, BY STATE AND CITY, by *Gertrude G. Broderick.* January 1960. 18 pp. (OE–34001.)

EVALUATING YOUR STATISTICAL SERVICES, A GUIDE FOR STATE EDUCATION AGENCIES, by *Allan R. Lichtenberger* and *Chalmers G. Norris, Jr.* December 1959. 62 pp.

THE NATIONAL DEFENSE LANGUAGE INSTITUTE PROGRAM, ANNOUNCEMENT FOR 1960–1961. 12 pp. (OE–27002.)

NDEA PROGRESS, TITLES III, V–A & X. MARCH 1960. 4 pp. (OE–20012.)

PUBLIC SCHOOL BUILDING AUTHORITIES, by *Elmer C. Deering.* Reprint from January 1960 *School Life.* 4 pp. (OE–21003.)

SOURCE MATERIALS FOR SECONDARY SCHOOL TEACHERS OF FOREIGN LANGUAGES, by *Marjorie C. Johnston* and *Esther M. Eaton.* January 1960. 26 pp. (OE–27001.)

SURVEY OF PUBLIC SCHOOL CLASSROOM SHORTAGES IN THE FALL OF 1959 IN BORROWED-UP DISTRICTS, by *Louis H. Conger, Jr.* February 1960. (OE–20011.)

TRANSFERS TO SCHOOLS OR COLLEGES OF ENGINEERING, 1951, 1952, 1953, AND 1959, by *Henry H. Armsby.* March 1960. 7 pp. (OE–54005.)

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